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Apprenticeship in a Small Shop

Operations Studied—Tendency of the Boys Toward Toolmaking—Their Lack of Practical Imagination—Natural Rate of Progress Cannot Be Accelerated

By A. W. FORBES

APPRENTICESHIP is today rather an indefinite term and when applied to a small shop is scarcely distinguishable from a job. A sharp line is not drawn between the apprentices and the regular employees in a small shop, while systematic instruction is seldom attempted and is not necessary. All the processes are carried on within sight of everyone and the boy may usually secure an opportunity to try any branch of the work, in which he is really interested.

The accompanying illustrations show boys, all under twenty years of age, at their regular work in the Forbes & Myers shop at Worcester, Mass. The large proportion of special machines and tools made in this shop furnishes opportunities always greater than the ability of the boy permits him to grasp, while there are, at the same time, enough parts made by the thousand to give him sufficient examples of production methods.

In Fig. 1 a boy is drilling through a jig. This is the simplest operation in the machine shop, and yet one in which there is more to learn than many machinists imagine. Probably the man who has spent his whole life in studying simple drilling operations would see more possibilities for further study in the subject than either the beginner or the machinist. Yet there has never been a man with a first-class intellect who would give his attention to machine shop practice. As a result, we know less of the fundamental theories of this subject than of the more complex ones such as electricity and heredity. The opportunities for the ordinary boy are greater in this field for he will find less competition with intelligent men.

The boy in Fig. 2 is acquiring skill in accurately spacing holes. A milling machine has been fitted with a small high-speed motor which drills through a hardened steel plate into the work. The work is moved by means of the usual milling machine feeds, and the holes are accurately spaced by the graduated dials.

The drilling attachment was made by the boy shown in the illustration, and he is here engaged in making a few changes to secure greater accuracy in drilling. It is possible with such apparatus to drill two intersecting $\frac{1}{8}$-in. holes and have them come out of the back of a $\frac{1}{4}$-in. plate accurate within a thousandth of an inch.

In Fig. 3 a boy is engaged in finishing spindles on a lathe. The lathe is often considered the basic machine of the machine shop. If a boy is given a thorough understanding of the various lathe operations, he will experience no difficulty in handling any of the other machines. In the operation illustrated in Fig. 3 an error of half a thousandth of an inch would be considered a bad mistake.

The field of the turret lathe includes production in moderate quantities, but not in sufficient quantities to justify the use of an automatic machine. Repetition work is essential to the thorough study of the action of a tool. Only in this way is it possible to see the fine differences which are caused by slight changes in the position of the tool. Without study repetition work is drudgery; with study it is one of the most interesting and instructive parts of the training. In Fig. 4 a grinding attachment is used on one operation in addition to the regular turret tools.

Being manufacturers of electric motors, it is natural that we should use them to a greater extent than manufacturers in other lines. The boy shown in Fig. 4 is here engaged in fitting his machine with three adjustable-speed, three-phase motors, one for each feed and one for the main power.

FIG. 1—DRILLING THROUGH A JIG. FIG. 2—ACCURATE SPACING OF HOLES. FIG. 3—FINISHING SPINDLES

FIG. 4—TURRET LATHE OPERATION. FIG. 5—FILING CLEARANCE ON A SPECIAL BROACH

Toolmaking is a highly developed form of machine work, and is a natural line of advance. Practical experience in using tools is an essential preliminary. However, to design and make a set of tools that will work right the first time, a thorough knowledge of the theory of the tool's action is necessary, a knowledge to be secured only through individual initiative and study. Fig. 5 shows a boy filing the clearance on the sides of the cutting teeth of a special broach which has already been machined to shape except for this clearance.

In Fig. 6 a boy is notching armature punchings. Metal stamping is usually done by mature men who have failed to advance to better positions, and in general this is probably the best class of person to do the work. However, as a preliminary to diemaking a certain period of working at the press is quite desirable. The advance from press hand to toolmaker can be readily made in any shop which is not over-systematized. The element of danger is one that has to be considered in using boys on metal stamping, but only a small part of the work is necessarily of much risk. The press is the only type of metal working machine on which we have never had an accident.

In Fig. 7 a boy is doing hand work on a fan die. These tools cut and bend to shape the fan blades used for cooling a small motor. The edges of the die over which the blades are bent, are now being rounded with a file. Metal stampings are one of the most important factors in electrical machinery. Making tools for this work, including the various punching, bending and forming operations is a highly skilled form of toolmaking. A certain amount of training in diemaking is also valuable for the motor designer.

In Fig. 8 are represented some metal stamping tools and the finished product secured with them. Nearly all the work of designing and making these tools was accomplished by a boy who had had twenty months of machine shop experience. Safety is an important fac-

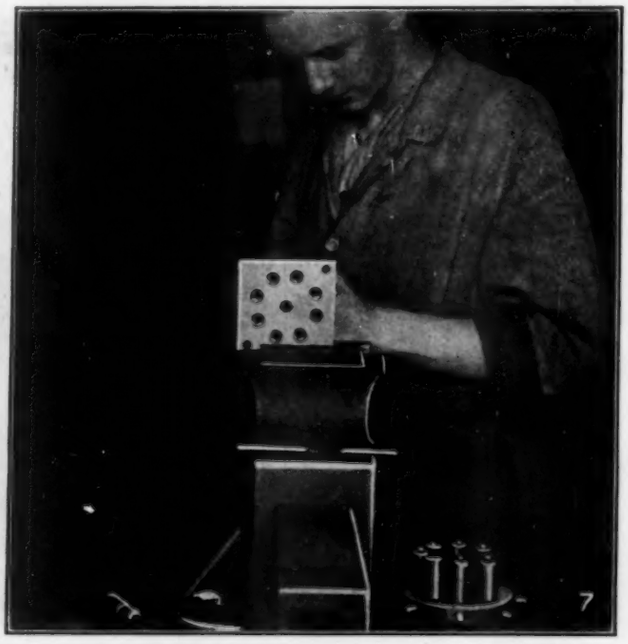


FIG. 6—NOTCHING ARMATURE PUNCHINGS. FIG. 7—HAND WORK ON A FAN DIE

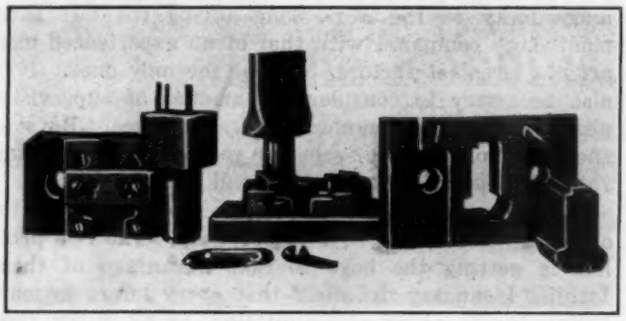


FIG. 8—METAL STAMPING TOOLS AND THE FINISHED PRODUCT

tor in the design of stamping tools. In this case in each operation after the blanking, the pieces are pushed into slots from the front, making it impossible to place the fingers under the punch except by a special effort.

Our work leads naturally in four directions, to the positions of foreman, salesman, motor designer, toolmaker and tool designer. We find that the boys take most naturally to toolmaking, some doing very creditable work after a short period.

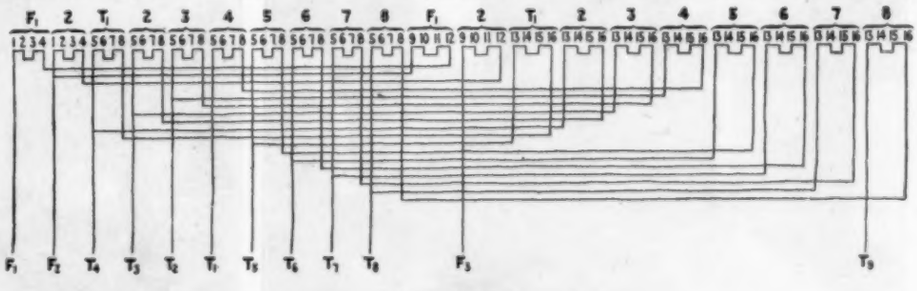
In Fig. 9 a boy is building a stator core. For time studies, few jobs offer an opportunity equal to this one. As this is entirely hand work, there is no limit to the speed except in the selection of the proper motions and in the rapidity with which they can be made. Time studies are essential for anyone who wishes to take part in shop management and the best time to learn the principles is while working on a job of this sort. Yet few boys take naturally to time studies, or for that matter to anything connected with management. It is probably best for the average boy to devote his time to the technical side of the work, leaving all questions of management until he is more mature.

Unquestionably the method shown in Fig. 10 is the fastest method of cutting a steel plate into irregular shapes. While it does not leave a finished surface, it has its use, and this use should be thoroughly understood by the designers of machinery.

Manufacturing processes require special machinery. We find it best to build most of this special machinery in our own shop. In Fig. 11 a standard bench press is being fitted with an attachment for rotating the blank while a row of notches is being punched around the outside edge. This press will make twenty-four slots in an armature punching, one at a time, spacing them accurately, in a total time of 9 sec. It is always a question of whether it is better to stamp the slots in this way, or whether it would be better to make a compound die; but, for special motors, the expensive dies are out of the question.

In Fig. 12 a boy is winding an electric motor. The mechanical processes of inserting the wires can be learned in a comparatively short time. The theory of the windings is an entirely different proposition. No boy should take up winding without possessing the interest in electricity and the practical imagination to carry through the study to such positions as electrical designer or research engineer. Very few do so, and I think the reason lies in their lack of imagination. The jump from the actual wires to the current inside and the magnetism outside is too much for the ordinary

FIG. 9—BUILDING A STATOR CORE. FIG. 10—CUTTING A STEEL PLATE. FIG. 11—ASSEMBLING A NOTCHING PRESS



Field	1 2	12 tps 12	# 20 24
Trans.	1 2		20
	2 3		20
	3 4		21
	4 11		22
	5 9		23
	6 13		25
	7 18		27
	8 27		28
Arm.	8		19

Estimated Speeds

Field Taps	Transformer Taps Prim.	Sec.	Speeds
183	185	184	9500
183	185	183	7500
183	185	182	5900
183	185	0	4700
183	186	0	3700
183	187	0	2950
183	188	0	2350
183	189	0	1850
182	187	0	1475
182	188	0	1175
182	189	0	935

Size 82

FIG. 13—A DIAGRAM OF CONNECTIONS

boy. He succeeds better with toolmaking where he can see more of what is going on.

Connection diagrams may be drawn out carefully by the draftsman, but a simple sketch by the designer serves the purpose equally well. Fig. 13 gives a diagram of a special three-phase adjustable-speed motor being built for the turret lathe shown in Fig. 4. Eighty wires coming from the coils in bundles of eight, can be easily mixed up. When connected by a boy as shown in Fig. 12 they always test out O.K. But some winders make mistakes, and it takes a great deal of imagination to discover which wires were interchanged without disconnecting all and starting again.

The boy in Fig. 14 is attending to some of the firm's correspondence. This is not stenography. The assigned mail is answered, indexed and filed. After the answer has been written it is taken to the proper person for approval and signature.

Saturday afternoons and other times when the shop is open but only part of the equipment in use, the facilities of the shop are available to the boys for making things for their own use. Electric toasters and wireless apparatus are made by the boys in this period.

The majority of the boys in our shop start work when they are fourteen or fifteen years of age. Of our present employees, all started shop work at either of these ages, and 83 per cent came to us before their sixteenth birthday. I think this is the best time to begin work, except for the brightest boys, who might be benefitted by an earlier start. Some boys work the full time from the beginning, that is 40 hours per week, according to the Massachusetts law for boys under sixteen years of age. Others spend part of their time in the shop and part in the city high schools, studying such subjects as mathematics, English, Latin and history. I think that boys who are in the shop should not study vocational subjects in school.

The pay starts at about 20 cents per hour, although it may start at a higher rate in some cases where previous work or study is of such a nature that it is of value to us. This pay is revised once in three months. In determining the rate at these revisions, the amount and quality of the work done during the last three months, as compared with that of an experienced man, are the greatest factors, but not the only ones. It is also necessary to consider the amount of supervision necessary and the regularity of attendance. Boys on short time or irregular schedule cannot expect the same rate per hour as those working full time.

The accompanying illustrations show some of the opportunities for the boys in our shop. The real problem is getting the boys to take advantage of them. I think I can say definitely that every effort to make boys advance along a special line, or to hurry their natural rate of progress has been a failure. It is possible to teach them facts as is done in school, but that is not real progress. We can show them how to do a given job, and they will then do that job better, but this work does not seem to prepare them for the next stage, unless it is consistent with their natural rate of progress. Corrections of mistakes are, of course, necessary, the giving of information when it is desired is often of benefit, and I am inclined to think a certain amount of systematic study is of value, provided it does not encroach on what a boy would naturally learn without it.

We have had some boys who have made considerable progress, such as shown by Figs. 7, 8, 11 and 12, but this progress does not seem to have been caused by any effort on the part of the management toward that result. In one of these cases, I thought the boy would do better in another line and directed his work with this in view, but without results. He made progress only when given opportunities in this one direction, and so naturally he was allowed to specialize in this line of work.

There is one thing that is essential to secure progress, and that is the proper selection of boys. If I am correct in my opinion that each boy has his natural rate of progress that cannot be materially accelerated, but may be retarded if opportunities are lacking, or if his mind is too much occupied with other things, then the principal factor is the selection of boys who have a natural rapid rate of progress in the direction in which the opportunities are offered.

FIG. 12—WINDING AN ELECTRIC MOTOR. FIG. 14—CORRESPONDENCE

Application of Bedaux Management Methods in the Robbins & Myers Plants

A Single Unit for All Activities — Estimating — Manufacturing — Inspection and Salvage—Knowing Costs at All Times—Reports and Graphs

BY L. C. MORROW
Managing Editor, *American Machinist*

SINCE 1918 Bedaux methods of setting work standards and compensating labor have been in operation in the plant of the Robbins & Myers Co., Springfield, Ohio. The results have been so thoroughly satisfactory during both boom and depression that a presentation in detail of the application of the Bedaux methods may now be given to the industrial world.

The Bedaux principle of human power measurement was explained in a previous issue of the *American Machinist* (page 241, Vol. 56). As therein defined it is a principle around which a system has been built whereby there can be expressed in one common unit the work done by every human being, whether laborer or supervisor, in relation to the work that should be done. That unit, called a B, is a fraction of a minute of work, plus a fraction of a minute of rest, always aggregating unity but varying in proportions.

There must, of course, be sixty of these units, or Bs, of productive effort plus rest in one hour and they constitute an hour's normal work, because they include all necessary allowances for rest, recreation, rebuilding, or whatever the renewal of human energy may be called. The system is the property of the Charles E. Bedaux Co., engineers, Cleveland, Ohio.

To show the application of the system, the Robbins & Myers plants have been chosen from some 28 plants, wherein the installation has been successful, because of the diversity of work performed. The products are electric motors, generators, fans, motor generator sets, radio apparatus and electrical parts for automobile starting and ignition systems involving some 200 different operations on 50,000 parts. The productive force of the plants when working at full capacity is 3,000 people. The corresponding clerical force in 200, including the personnel of the standards and planning departments.

The Robbins & Myers organization is not of an unusual type, as may be seen from the chart, Fig. 1. So far as the actual carrying on of the system is concerned, the entire chart may be forgotten, except for the standards and planning departments and those departments that they control. Shop departments now on B work are indicated in the following list: Receiving (partly), material (partly), time keeping (partly, Hollerith punch operator), standards (partly, posting and stenographic), salvage (partly, inspectors), foundry molding, raw material stores, saw and shear, cleaning and chipping, punch press, drill press, lathe, boring mill and heavy machine, screw machine, grinding and shaft turning, J. & L. turret lathe, form making, a.c. armature, d.c. armature winding, armature core building, commutator, polishing and buffing, plating and japaning, medium armature winding, parts stores, polyphase coil winding and inserting, coil winding, small armature winding, small a.c. field inserting, large armature winding, armature assembly, armature finishing, armature inspection, polyphase motor assembly, large d.c. motor assembly, small a.c. motor assembly, motor testing (50 per cent), fan assembly, motor packing, fan testing and fan packing.

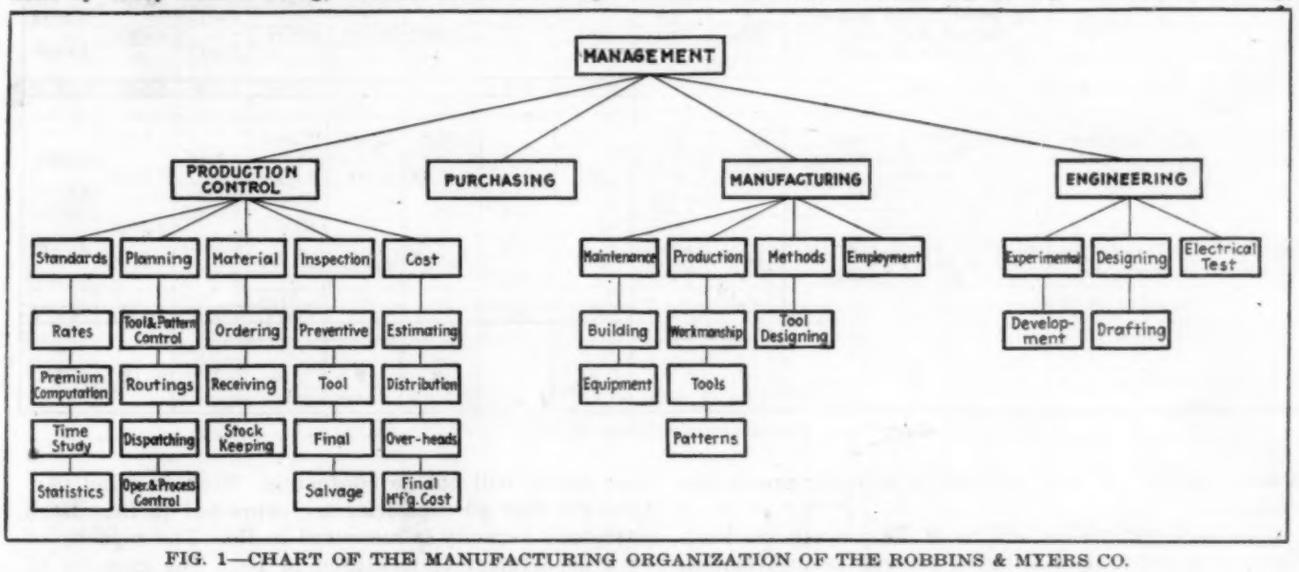


FIG. 1—CHART OF THE MANUFACTURING ORGANIZATION OF THE ROBBINS & MYERS CO.

Of great importance is the standards department. Briefly its duties are to take time studies, set standards, keep records, make adjustments, make analyses.

Time studies are made with the stop watch by men who have been chosen from the shop because they themselves can do the work they are timing, and the best operator in the department is, as a rule, selected as the subject.

Such standards are set that a normal effort will produce sixty Bs of work per hour. Added effort will increase production, and a proportionate reward is given.

DRAWING NUMBER	DESCRIPTION	OPERATION	DEPARTMENT NUMBER	STANDARDS IN Bs			COST PER B		COST NET LABOR		TOTAL	
				TOTAL	SET-UP	MACHINING	LABOR	LABOR & OVERHEAD	SET-UP	MACHINING	LABOR PLUS OVERHEAD SET-UP	LABOR PLUS OVERHEAD MACHINING
X 814	Size 5 x 9 Gear	Set-up 3 and 4 single	6200	60.0	60.0		0.00721	0.0163	0.4326		0.9780	
	" " " "	176 A Face, Bore & Ream	"	14.0		14.0	"	"		0.1009		0.2282
	" " " "	Set-up Lathe	6100	45.0	45.0		0.00568	0.0166	0.2556		0.7470	
	" " " "	93 A Face 1 end	"	2.5		2.5	"	"		0.0142		0.0415
	" " " "	93 B Turn & spare	"	12.0		12.0	"	"		0.0681		0.1992
	" " " "	Set-up Grinder	"	30.0	30.0		"	"	0.1704		0.4980	
	" " " "	68 Grind 5" Diam	"	12.0		12.0	"	"		0.0681		0.1992
	" " " "	Set-up Multi Drill	5800	30.0	30.0		0.00577	0.0153	0.1731		0.4590	
	" " " "	104 A Dr. 18 9/16" holes	"	3.0		3.0	"	"		0.0173		0.0459
		Total			165.0	42.5			1.0317	0.2686	2.6760	0.7126
X-832	Size 4 1/8 x 7 Gear	Set-up 1 & 2 single	6200	60.0	60.0		0.00721	0.0162	0.4326		0.9720	
	" " " "	176 A, Face, Bore, Ream	"	10.0		10.0	"	"		0.0721		0.1620
	" " " "	Set-up Lathe	6100	60.0	60.0		0.00568	0.0166	0.3408		0.9960	
	" " " "	93 A Turn & Face flange	"	4.0		4.0	"	"		0.0288		0.0664
	" " " "	93 B " " 4.5007 "	"	6.0		6.0	"	"		0.0340		0.0996
	" " " "	Set-up Grinder	"	30.0	30.0		"	"	0.1704		0.4980	
	" " " "	68 Grind 4.500 Diam.	"	8.0		8.0	"	"		0.0454		0.1328
		Total			150.0	28.0			0.9438	0.1803	2.4660	0.4608
X 819	Size 1 3/4 x 3 1/2 Gear	Set-up 1, 2 & 3 single	6200	60.0	60.0		0.00721	0.0162	0.4326		0.9720	
	" " " "	176 A Face & Bore	"	5.0		5.0	"	"		0.0360		0.0810
	" " " "	Set-up Broach	6100	15.0	15.0		0.00568	0.0166	0.0852		0.2490	
	" " " "	9 A Broach 1-2 Diam.	"	2.0		2.0	"	"		0.0113		0.0332
	" " " "	9 B " 1-2 "	"	2.0		2.0	"	"		0.0113		0.0332
	" " " "	Set-up Lathe	"	45.0	45.0		"	"	0.2556		0.7470	
	" " " "	93 A Face end	"	0.8		0.8	"	"		0.0045		0.0132
	" " " "	93 B Turn 1.501 Diam.	"	2.5		2.5	"	"		0.0142		0.0415
	" " " "	Set-up Grinder	"	30.0	30.0		"	"	0.1704		0.4980	
	" " " "	68 Grind 1.500 Diam.	"	3.0		3.0	"	"		0.0170		0.0498
	" " " "	Set-up Mul. Drill	5800	30.0	30.0		0.00577	0.0153	0.1731		0.4950	
	" " "	104 A Drill 9-#" holes	"	3.0		3.0	"	"		0.0173		0.0459
		Total			180.0	18.3			1.1169	0.1116	2.9610	0.2978
X827	Size 4" x 8 Gear	Set-up 1, 2 & 3 single	6200	60.0	60.0		0.00721	0.0162	0.4326		0.9720	
	" " " "	176 A Face, Bore, Ream	"	12.0		12.0	"	"		0.0865		0.1944
	" " " "	Set-up Lathe	6100	45.0	45.0		0.00568	0.0166	0.2556		0.7470	
	" " " "	93 A Face one end	"	2.5		2.5	"	"		0.0142		0.0415
	" " " "	93 B Turn & spare	"	5.0		5.0	"	"		0.0284		0.0830
	" " " "	Set-up Grinder	"	30.0	30.0		"	"	0.1704		0.4980	
	" " " "	68 Grind 4.000 Diam	"	8.0		8.0	"	"		0.0454		0.1328
	" " " "	Set-up Mul. Drill	5800	30.0	30.0		0.00577	0.0153	0.1731		0.4590	
	" " " "	104 A Dr. 12-#" holes	"	3.0		3.0	"	"		0.0173		0.0459
		Total			165.0	30.5			1.0317	0.1918	2.6760	0.4976
1	2	3	4	5	6	7	8	9	10	11	12	13

FIG. 2—ESTIMATING FORM

Reward applies to both productive and non-productive workers.

Only such records as will be of future use are kept. There is a constant clearing of records as information is drawn off for analytical purposes.

Adjustments generally consist of determining whether or not an operator is to be paid for reworked operations. There are certain well defined rules about reworking that are entirely intelligible to the operator, yet are sometimes difficult of application, so that his calling attention to a case is in the nature of asking for information, rather than by way of complaint.

Analyses are made for the use of management. They are few and simple, yet true and complete, as will be shown by the sample forms given later.

Duty of the Planning Department

Expressed as briefly as possible the duty of the planning department is to assign the parts to be manufactured to the departments that will manufacture them. It is an important department because from it emanate all delivery promises. It controls shop orders in every way—routing, follow-up and records.

The preceding paragraphs are intended to give a conception of the system and its operation as a whole. If definitions and principles are kept in mind the details that follow will not be confusing. Bear in mind particularly that all capacities are expressed in Bs. Each operator's capacity is measured in Bs. The capacity of each department is measured in Bs. The capacity of the entire plant is measured in Bs. The requirements of work are expressed in Bs, estimated work as well as work that has been made before. All results are measured and tabulated in Bs. Cost is figured as cost per B. The entire plant is therefore thinking and talking in terms of one and the same unit.

Following Through an Order

For the purpose of this article, we will suppose that the Robbins & Myers Co. is asked to estimate on a motor similar to its standard motors, but enough different that the company does not feel justified in saying, "They are just like our XY motor and we'll make them for Z dollars apiece." The company receives and fills the order and we are privileged to see how the estimate was prepared, the delivery dates determined, the work routed, manufacture carried on and inspection and salvage conducted. We are also permitted to see that the company knew at all times just what were its costs on the job and that there were no continual leaks, permitting profit to escape.

Specifications of the new motor were given to the

standards department for estimating. The first step was to make up an operation list and enter it in Col. 3 on the estimating form shown in Fig. 2. The engineering and planning departments were important factors in making up such a list and in specifying the departments in which the operations would be performed. The standards department then determined the number of Bs required for one operator for each operation and entered it in Col. 5. These standards were determined by making use of the records of accomplishment on previous work. The standards were then split up to show Bs for set-up and for machining and the results entered in Cols. 6 and 7.

The cost per B for a given operation in a given department, known from definite rates established on each class of work and from records of past performance, was entered in Col. 8. Overhead was added and the result placed in Col. 9. Multiplying Cols. 6 and 8 together gave the cost of labor for set-up, Col. 10. Multiplying Cols. 7 and 8 gave the cost of labor for machining, Col. 11. The costs of labor plus overhead for set-up, Col. 12, and of labor plus overhead for machining, Col. 13, were obtained by multiplying together Cols. 6 and 9 and Cols. 7 and 9 respectively. The resulting costs per operation per piece had to be multiplied by the number of pieces on the order to obtain the total cost of the job.

THE ROBBINS & MYERS CO.

Follow Card

*To be filled in only when used as sent ahead card.

*Card Number

*Last Operation

Name of Part

Drawing Number

Order Number

Amount of Order

Date Ordered

Lot Number 2034

Amount of Lot

Ordered by

Amount Sent Ahead	Card Number	Date	Amount	Last Operation	Sent by

Amount Finished

Date Finished

Dept. No. 6100

SEND TO DEPARTMENT CLERK WHEN WORK IS SENT TO INSPECTORS

SEND TO INSPECTORS WITH WORK

Operation Number	Employee Number	Standard	Amt. Lost Rej.	Amt. Lost Scrap.	Dept. No. 6100

Order Number	Lot Number 2034	Drawing Number	Amount Received	Amount Passed	Amount Scrapped	Amt. to be Reoperated	Defective Operation	Date	Inspector	Name of Part

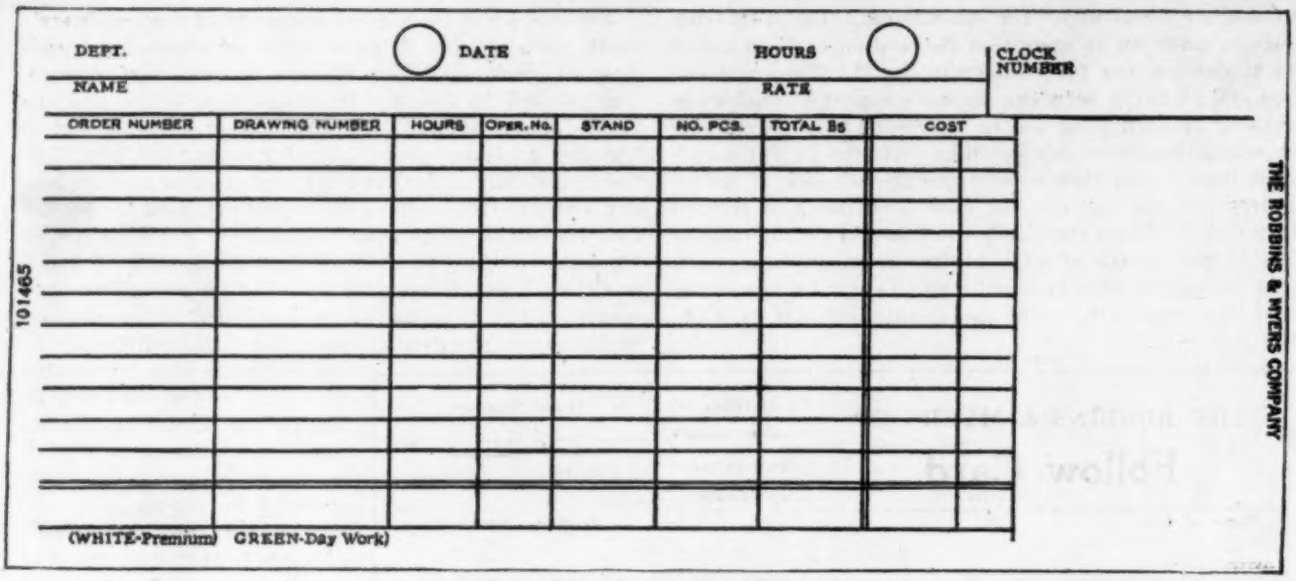
Form 619

FIG. 3—FOLLOW CARD

The estimate thus completed was given to the sales department. The entire calculation was of course based on a specified quantity in order to charge correctly for set-up.

With the shop costs made available in that way, the sales department added the cost of general overhead and the amount necessary for profit and submitted the bid to the customer. It was a competitive bid, but we are assured by the Robbins & Myers Co. that in presenting it there was no doubt that if the order should be received and executed, a very satisfactory profit would be obtained. The figures were evidently acceptable to the customer as the order was placed without questioning the price.

Upon receiving the formal order, the sales manager caused the necessary copies to be made, among them one for the planning department and two for the engineering department to be delivered later to the planning department. The copy sent directly to the planning department was an advance notice of the new job. The two copies sent to the engineering department were supplemented in that department by notations and specifications before being sent to the planning department. Upon receipt of those two copies the planning department analyzed the job, giving to the sales department the necessary lot or part delivery promises and attaching to the order riders containing statements of those promises. One copy of the order was then sent to the material department where the material list of the engineering department was assigned on the stock record to determine the amount


DEPT. DATE HOURS CLOCK NUMBER

NAME RATE

ORDER NUMBER	DRAWING NUMBER	HOURS	OPER. No.	STAND	NO. PCS.	TOTAL Bs	COST	

(WHITE-Premium) GREEN-Day Work)

101465

THE ROBBINS & MYERS COMPANY

FIG. 4—OPERATOR'S TIME TICKET

of additional raw material to be purchased and the manufactured parts that were not available in the stockrooms.

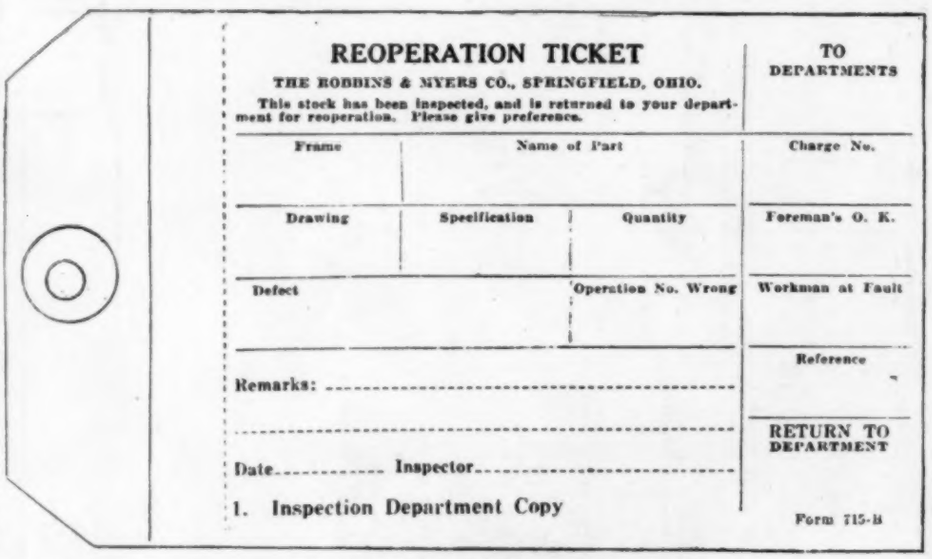
Requests for raw material were placed upon the purchasing department, giving the quantity, specification and date needed. The material department also placed requests on the planning department for any manufactured parts needed. Requisitions for raw material and parts on hand were sent to the planning department. Immediately upon receipt of materials that had to be purchased, additional requisitions were made by the material department and delivered to the planning department. No shop tickets were placed by the planning department in the factory until the necessary material had been received and delivered to the stockroom.

Was the planning department able to set delivery dates that it felt capable of living up to, and were those dates met in every particular? The answer to the first part of the question is yes, on the assumption that material could be obtained without delay. The answer to the second part also is yes, except on a few parts where delivery of material was delayed by causes that could not be foreseen. A reasonable factor of safety was used by the sales department in making a delivery promise so that the order was filled well within the dates specified in the contract.

By keeping its records in Bs and because the estimate was made in Bs the planning department knew how much time would be required for each operation in each department. It also knew how much work on other products was ahead of each department and for that matter each machine of each department, when the new order was placed. And the possession of such knowledge did not require an inventory in the shop. It was already on hand because each shop order, in the system followed, shows the amount of work in Bs involved in each operation in each department and the machine the operation is to be performed on. Expressed in another way, the planning department knows at all times how many Bs may be issued against each machine, since it knows that machine's capacity in Bs and the load that it is carrying. Once it has been determined that a certain operation is to be done on a particular machine, everything about that operation may be forgotten so far as capacity to produce is concerned, except the Bs required to produce it and the B capacity of the machine. It is necessary that records be kept of the Bs work assigned to each machine, until completed.

An additional value of such a system for setting capacities against requirements is that the planning department is enabled to advise the material department just when material must be on hand. Likewise it knows that material must not be ordered to the departments before a given time in order to prevent congestion and interference with other work in process.

Details of planning department routine are few, yet they cannot be fully described here. Briefly they include the sending of the shop orders to the shop dispatchers, the checking up of finished orders, and the


REOPERATION TICKET

THE ROBBINS & MYERS CO., SPRINGFIELD, OHIO.

This stock has been inspected, and is returned to your department for reoperation. Please give preference.

TO DEPARTMENTS

Frame | Name of Part | Charge No.

Drawing | Specification | Quantity | Foreman's O. K.

Defect | Operation No. Wrong | Workman at Fault

Reference

Remarks: .....

RETURN TO DEPARTMENT

Date..... Inspector.....

1. Inspection Department Copy

Form 715-B

FIG. 5—RE-OPERATION TICKET

SCRAP MATERIAL No 48235

PRODUCTION DEPARTMENT

Date	Scrapped In Dept.	Dept. At Fault	Inspected By
Drawing Number	Name of Part		
Scrapped on Oper. Number	Last Oper. No.	Order Number	Workman At Fault
Amount In Lot	Amount Claimed	Amount Rejected	Percent Rejected
Day Rate	Stand	Total Bs	Rate Per B
Cause of Rejection			

Labor Cost		
Factory Burden		
Mat. Cost		
Total Cost		

Form 189—50m—1-19-21

FIG. 6—SCRAP MATERIAL TICKET

following-up of delinquent orders, the last named entailing the use of a "delinquent board." The order sent to a dispatcher shows the dates upon which the order should be started and finished. The dispatcher possesses a dispatch board laid out by groups and machines. Pockets on the boards carry load cards giving the capacities of the machines. When the dispatcher puts a job on a machine he notes the load that it is carrying, and is guided thereby. A balance of all load cards is made each day, between work assigned and work finished, so as not to overload. Loads are expressed in Bs.

The dispatcher occupies an important place. He ties up with both planning and standard departments. In addition to handling load cards, he receives the planning department job tickets, and distributes them to the foremen in his department. He requisitions materials, having them delivered either to the machine on which they are to be worked or to other designated positions. (Job tickets are never issued until the material is in stores.) He also returns to the planning department the shop orders as they are completed.

Let us now see how the actual production takes place. It is of course guided by the standards department. Whenever possible on the order we are observing an operation was given a B value, that is, arranged on a premium basis. Many of the operations are nearly identical with operations on the company's standard work, so that it was possible to set B values before the first lot was ordered into the shop. On the other operations, time studies were taken on the first lot and standards set in time for the operators to be paid on a premium basis.

Name Type of Mach.

Dept. No	Oper. No.	Description of Operation	Mach. No.	Stand	Set Up Stand	Rate

Form 593

FIG. 7—DEPARTMENTAL OPERATION REFERENCE CARD. FRONT AND BACK ARE ALIKE. SIZE 4 x 6 IN.

THE ROBBINS & MYERS CO.

STD GOOD. STD. BAD DEPT. No. DATE

NAME OF PART

OPER NO.	PER CENT. INSP	DESCRIPTION OF OPERATION

INSP. DEPT	TOOLS USED	TOOL CRIB

ROUTING

REMARKS

FIG. 8—INSPECTION OPERATION REFERENCE CARD, FRONT AND BACK. SIZE 4 x 6 IN.

Before examining the details of the shop forms and records, it should be fully understood that the Bedaux system does not make use of piece rates. Each employee is hired at an hourly rate, the amount depending upon the rate for labor of the class to which he belongs in the locality in which he works. His job is then given a B value that is guaranteed. His hourly rate is guaranteed temporarily, being subject to change either upward or downward according to general conditions. If it becomes necessary to reduce wages (and that such a neces-

sity at times exists there can be no question) the hourly rate is reduced with no adjustment of B values. Once such a reduction has been determined upon the standards department issues written instructions to foremen, giving the new hourly rates for the various classes of employees. The foremen tell the employees what their new rates are, at the same time explaining why the change has been necessary. There always is a reason because a cut is never made unless necessary. Stated in a broad way, the chief reason is the necessity to meet competition. Just as rates are cut on what might be termed a falling market, so they are increased on a rising market. The method of notification is the same. We have always felt that a cut in piece rates was a sure way to precipitate labor trouble in a shop, so we are impelled to inquire as to how the system of guaranteeing B values and making adjustments in the hourly rates works out. We are assured by no less an authority than the head of the standards department that the amount of trouble caused has been almost negligible. But he tells us also that the secret of having no trouble is confidence of the men in the management, not only in the matter of hourly rates, but in time setting, inspection, premium accounting, adjustments, in a word, all relations. He says that the same is true of all successful systems, but particularly of the Bedaux system on account of its single standard of value.

The base rates, we learn, are set by a committee, composed of (1) the head of the standards department, (2) either the department superintendents or the general superintendent, (3) the head of the production control department and (4) an executive representative. In changing base rates the policy is to change the rates of the entire plant, though that cannot always be done.

In following the work of the standards department it is seen that there are few forms with which the shop comes in contact. The job ticket has been referred to. There are also the follow card, the operator's time ticket,

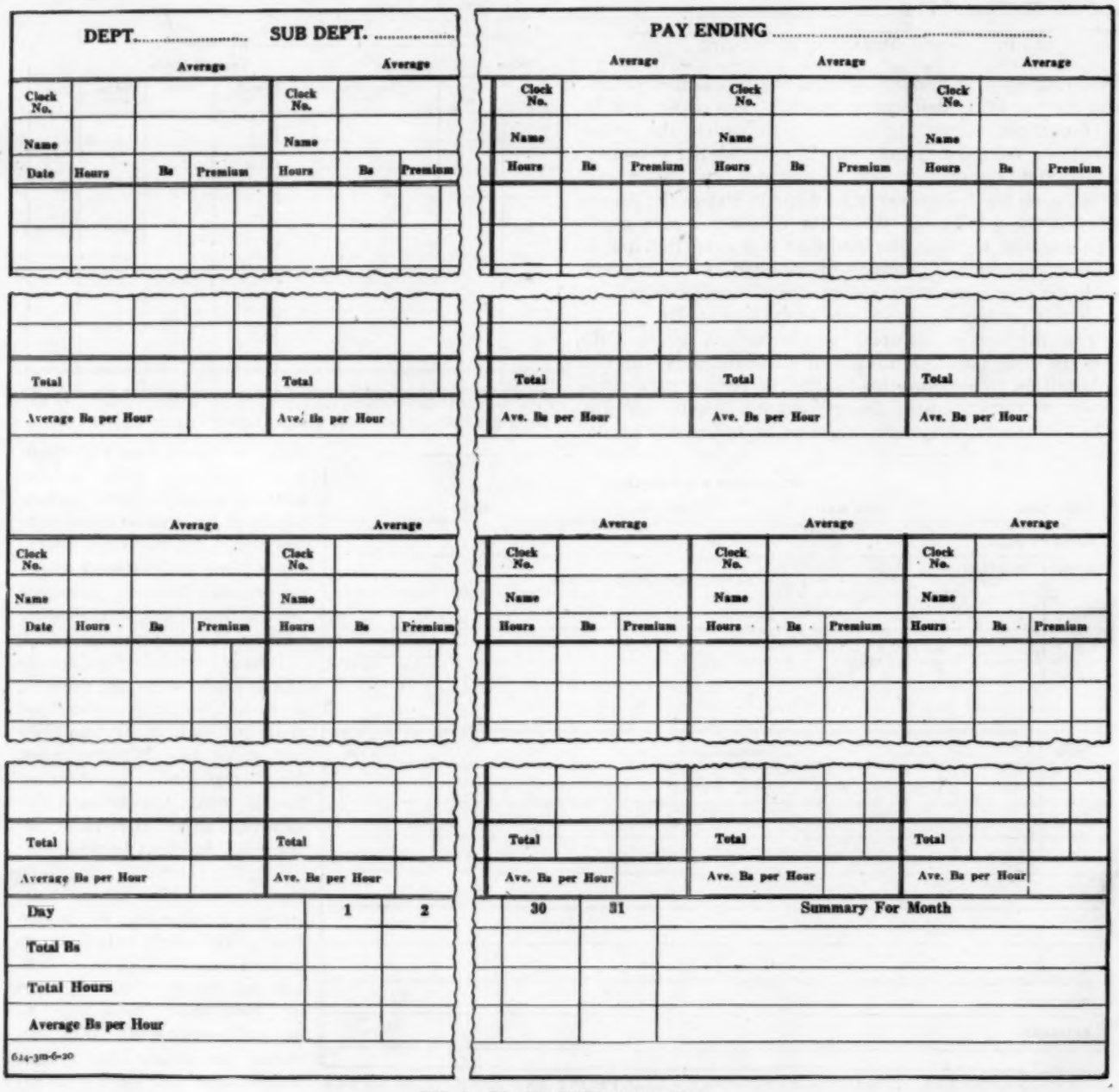


FIG. 9—PLANT POSTING SHEET

the re-operation ticket, the scrap material ticket, the departmental operation reference card, the inspection operation reference card, and the posting sheet.

The follow card, Fig. 3, is made out by a clerk known as the production clerk. Upon completion of the lot the two parts of the card are separated, the lower being sent with the work to the inspection department to be returned with proper entries made after the work has been inspected. The upper part stays with the premium clerk for purposes of record and for comparison with the inspector's part upon its return. It should be noted that the inspector must determine his own count, as the inspector's copy contains no information as to the number of pieces. A blind count is required on all work so that the inspector's count can be verified by the premium checker, as it is found that in a plant where there is a large quantity of small pieces being made daily it is of the utmost importance to know, and have positive check on, the amount of work being completed by operators daily. The inspection department is held responsible for the final count for the reason that all work completed in a given department must be handled by the inspection department before being transferred to the next department or operation.

Each operator is provided daily with a time ticket on which certain entries are made by the premium checker. See Fig. 4. At the close of the day, the ticket is turned in to the standards department, from which it is sent on to the payroll department. The operator is paid at the close of the pay period for the number of hours shown on his time tickets for that period at his base rate, and premium for the Bs produced above his standard requirement. The time ticket serves the additional purpose of furnishing information for the Hollerith cards.

The inspection department has three classifications for inspected work, passed, scrap and re-operation. It fills out the two forms "Re-operation Ticket" and "Scrap Material" shown in Figs. 5 and 6. The re-operation ticket is sent to the premium checker who deducts the B values of the rejected work from the operator's productive Bs. If re-operation is due to no fault of the operator, the operator does not lose. Reworking must be done, of course, and responsibility for the error must be fixed on the proper person or department. Credit is given to the operator for the reworked pieces after they have passed inspection. Four copies of the re-operation ticket are made, one a tag to remain with the work, the three others on three colors of paper for the operating department, the originating department and the inspection department.

Four copies of the scrap material form are made, one for the salvage department, on a card, to be attached to the work, the three others on three colors of paper, for the originating department (it goes to the operator), the standards department and the production department. The B values on scrap tickets are subtracted from the operator's productive Bs. At specified intervals reports are made by the inspection department of the amounts of scrap chargeable against individual operators. They are sent to the department heads.

Two other forms were mentioned, the departmental operation reference card and the inspection operation reference card. They are shown in Figs. 7 and 8. As the names imply, they are production and inspection record cards that are used for reference. For example, each department in the shop holds a set of reference cards that contain the records of its operations. A duplicate set is held by the standards department which also holds a master set showing all operations in all departments. This set is available for cost determination. A master set also is located in the planning department.

Still another form has been referred to, the plant posting sheet. The cut, Fig. 9, shows ten units of the thirty that the sheet contains. By referring to this sheet, which is posted in a conspicuous place, toward the close of the day, the operator may see just what he is accomplishing, and also the other fellow's record. Operators below 60 B (standard) are posted in red.

(To be concluded next week.)

"Scrapping" Employees

By Robert Grimshaw

There are two reasons for "scrapping" equipment, uselessness and unfitness. Just as a machine may be worn out, obsolete, or unfitted for the purposes of the establishment, so the workers may be useless for three reasons. In the first place, they may be no longer physically or mentally capable of doing efficiently the work they had been doing satisfactorily. In the second place, they may constitute elements of discord; or in the third place, they may merely be square pegs in round holes. In any of these cases, scrapping is usually advisable, but never, never on the same basis that applies to equipment. It is necessary to treat the human element from a different viewpoint; it should never be considered as an abstract quantity.

With the second class, which is composed of those who sow discord or discontent among their fellows, or quarrel with the workers and the management, there is usually but one course to pursue; present them, at the psychological moment, with the well-known "key of the street." They would be dear at any price. Of course, if they can be reasoned with and converted from destructive to constructive elements, it is better to retain them. But no amount of threats will abate the evil.

As regards the first and third causes for scrapping, "justice" (that is, to the whole establishment) "must be tempered with mercy" (to the employees). The first step should be to see if the incompetence is not the fault of the management for imperfect instruction and supervision. If so, the fault should be remedied by the one responsible for it. The man should be taught and guided, patiently and competently. When one has a horse that has become balky by bad driving, the animal must not be discarded, but must be cured of his trick by a competent and patient person. Why not apply the same principle to human beings?

The third cause is often due to improper selection and assignment. The remedy is simple and very often highly effective. Shifting should be tried at least once, and sometimes twice, but never three times. The reason for the shift must be clearly shown to be in the worker's own interest. If he cannot be made to see this reason plainly, the one who has tried to explain it to him may be at fault, and someone else may be more logical or more convincing. Sometimes a shopmate who is not personally interested can help out, and at times "friend wife" can be of use.

Manufacturing Calculating Machine Side-Frames

Methods and Tools Used by the Monroe Calculating Machine Company—Locating Points for Various Operations—Gages and How They Are Used

BY FRED H. COLVIN
Editor, *American Machinist*

THE manufacture of the side frames for the machines made by the Monroe Calculating Machine Co. in its new plant at Orange, N. J., involves a number of interesting features. The frames are made in rights and lefts for the opposite sides of the machine, the left-side frame being shown in Fig. 1 in four different stages. The first operation, after the castings

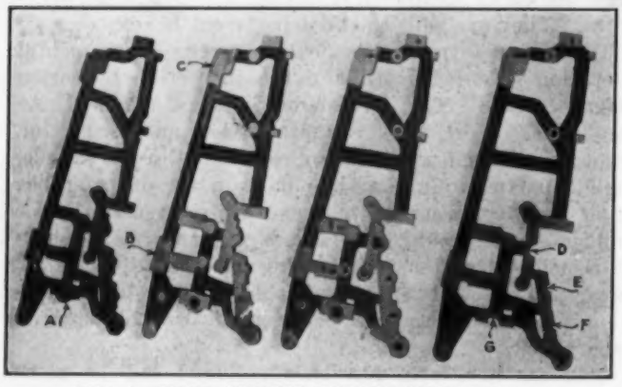


FIG. 1—FOUR STAGES OF THE SIDE FRAME

are snagged and trimmed, is to japan them, which makes them very much better to handle in every way than the plain cast iron. Next comes the rough- and finish-grinding. The first is done on a disk grinding machine, after which they are finish-ground on a Pratt & Whitney vertical spindle machine equipped with a magnetic chuck. This finish grinding secures a uniform thickness and also provides a flat surface on each side, which condition is important in assembling the machine. The tolerance is 0.003 in. The working inspection is with micrometer, but a snap gage is used for final inspection.

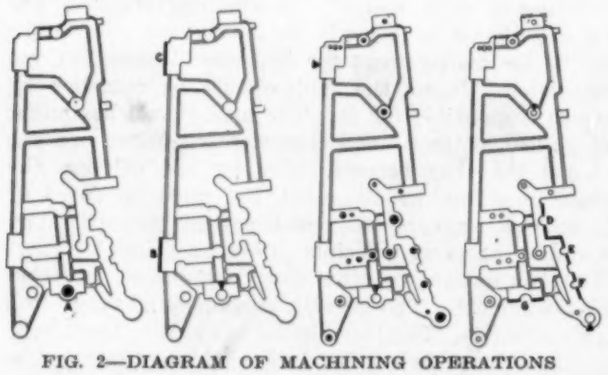


FIG. 2—DIAGRAM OF MACHINING OPERATIONS

The drilling operations begin with the large hole at *A*. This is very clearly marked by a conical depression in the casting as can be seen in Fig. 1. Fig. 2 shows the work in outline, the leading operations being indicated by heavy black dots for drilling and by lines for milling. The black triangles show locating points. Figs. 1 and 2 can be studied together to advantage.

Using the hole *A* as the first locating point, the frame is supported on a light milling fixture, and the two pads *B* and *C* milled to form the supports for the frames and the entire machine. Future operations use the pad *C* and the hole *A* as the locating points.

The milling of the feet is with reference to the first hole drilled. The distance from the foot to the hole is tested by the block and plug shown in Fig. 3. A plug in the hole *A* and the block *B* give the correct distance for either setting the milling cutter or testing the frame after milling.

Next comes the drilling of twenty-one holes as shown

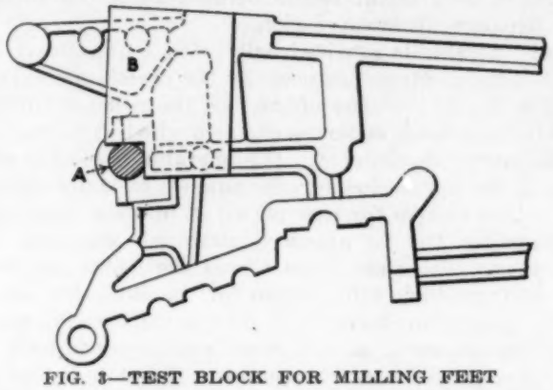


FIG. 3—TEST BLOCK FOR MILLING FEET

by both Figs. 1 and 2, the drilling jig being shown in Fig. 4. Here it will be noted the side frames rest on the lower surface of the jig, and a locating pin enters the hole *A*, while the surface *C* (Figs. 1 and 2), rests against a hardened steel block at *B*.

The knurled knob *D*, Fig. 4, controls a cam which holds the frame firmly against *B* during the drilling operation. It will also be noted that the upper plate of the jig which carries the hardened drill bushings is provided with four hardened buttons, *E*, *F*, *G* and *H*, which bear on the ground surface of the side frames. There are also four more hardened buttons in pairs at *I* and *J* which bear on corresponding buttons at *K* and *L*. These buttons aid in holding the drill bushings in the proper plane so as to insure all the holes being drilled square with the frame.

The drill jig cover or bushing plate is locked in position by the turn buttons shown at each end and is also provided with projecting handles so as to be easily raised into the position shown. The jig is used on a six-spindle drilling machine, being moved from spindle to spindle, so that all the various size holes may be drilled at one setting of the frame in the jig.

The location of all the holes is tested after drilling, by a gage made of another frame with pins in each hole. These pins are made with shoulders so as to drive into the frame used as a gage and have the outer ends rounded to aid in entering them into the holes.

The next operation is that of milling for four bearing caps and is a somewhat unusual method in work of this

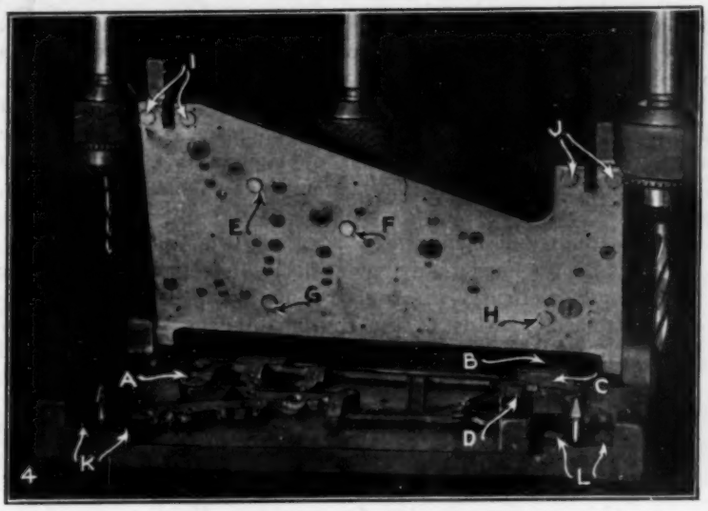


FIG. 4—DRILLING THE SIDE HOLES.

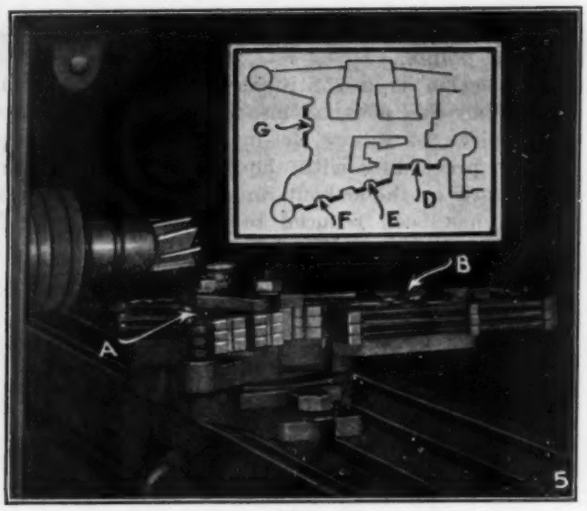


FIG. 5—MILLING FOR BEARING CAPS

kind. The side frames are mounted in groups of three on a knee type milling machine as shown in Fig. 5. The frames are located by pins in reamed holes at *A* and *B*. The milling operation removes the metal surrounding the upper part of the holes for shafts at *D*, *E*, *F* and *G*, shown by the outline above the milling fixture and also in Fig. 2. In Fig. 5 the other surfaces have been milled and the fixture swings around to the second index point for milling the last bearing *G*. The heavy lines show the milled surfaces.

More Drilling and Tapping

In the drilling operations which follow, holes are drilled and tapped for the screws which hold the bearing caps. The caps hold die cast bearings in place, making an unusual construction for machines of this type, but adding materially to their life on account of the cost of replacing bearings. It also aids in assembling the machine.

Some of the drilling and tapping operations which follow are shown in Fig. 6.

This view shows the type of fixture used for most of the holes in the edge of the frame. In the fixture at the left the frame is located in position by the pins *A* and *B*, which insure the holes for the two bearing caps being held level for tapping. The center fixture is used for drilling the bottom feet of the frame. It will be noted that this fixture has feet on three sides, so that it can be used in various positions. Drilling bushings are provided at *C*, *D*, *E* and *F*. It will also be seen that, in order to insure firm and accurate setting in the different positions, hardened steel spots are provided on all the feet.

Another drilling fixture is shown at the right, being for the holes in the angular bearing caps. The frame is located on the upper pin *G* and swung up into contact with the underside of the ledge carrying the hardened steel drill-bushings. The frame is held by the hook bolt *H* operated from the back side of the fixture. This is in contrast to the long strap used in the center

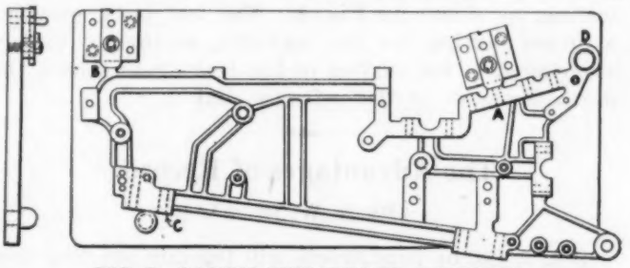


FIG. 7—GAGING THE MILLED SURFACES

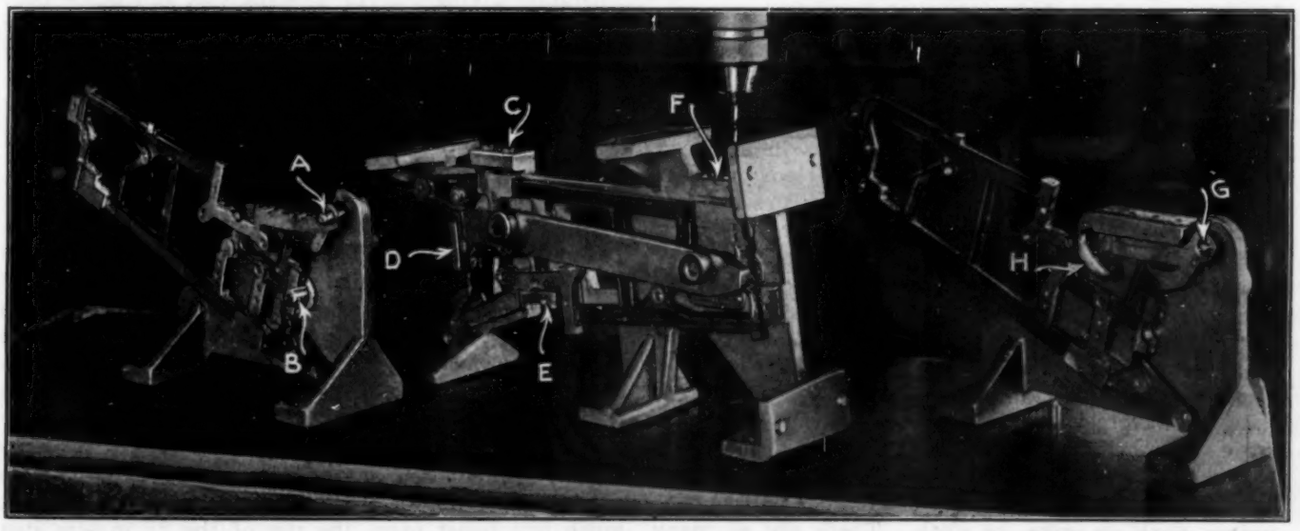


FIG. 6—DRILLING THE EDGE HOLES

fixture for clamping the frame at both ends near the drilling points.

Inspection is a continuous process in the Monroe plant, but this does not mean that it is overdone. The first piece of a new set-up is inspected and passed before proceeding with the job. Floor inspectors are constantly on the lookout for errors to prevent spoilage, which has been reduced to a low point. So far as

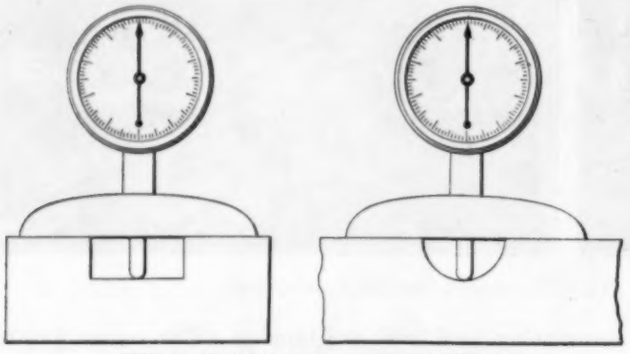


FIG. 8—GAGE FOR BEARING DEPTH

practicable the fixtures are made to check the preceding operation. But a final checking takes place before going to assembly.

The relations between the angular bearing surface *A*, the upper surface *B* and the foot *C* are tested as in Fig. 7. The foot rests against the pin, while the upper hole fits over the stud *D*. The two flush-pin gages at *A* and *B* test the accuracy of the points mentioned.

The depth of the half-holes for the shafts is also tested in an interesting manner, so as to be sure that the milling is at the proper depth to leave a half circle. An Ames gage with a special foot is used for the testing, as shown in Fig. 8. The test block provides a proper setting for the indicator, so that by simply applying it to the surface of the bearing as shown, the depth is shown on the indicator dial.

The Advantages of Records

BY A. W. BROWN

Dun & Co. or Bradstreets will tell any one who does not know it, that a large proportion of the business failures, especially of those in manufacturing concerns, is due to the lack of records, or to the reliance on those who do not measure up to the proper standards of what a record should be. Records are more than mere guides. They are insurance. The shop where the foreman carries the piece-work rates in his head is at a disadvantage if he dies or quits—or forgets; or if the workers dispute his statements as to what was agreed upon. Records also enable the after-calculation and the fore-calculation of costs, and make proper tenders for the work. They foil the insurance adjuster's efforts to adjust fire losses downwards, and show the management (and the owners too, if the management is independent of the ownership) whether the business is going up hill or down, at what rate and why. One thing, however, is certain: When records have been made, they should be often consulted.

Anyone who knows horses well can lay down the requisites of the perfect horse, as can also one who judges dogs, or guns, or cloth. There are so many desirable qualities, and so many points to be accorded for the possession of each of these necessary features.

But a very few who use records give themselves the trouble to formulate the essential record characteristics. For that reason, there are fewer really good and profitable records than there should be. A record to be real and stand the test of time and use should be accurate, up to date, comprehensive, unprejudiced, accessible to those entitled to use it, untamperable, legible and comparable with records in similar lines.

These have many advantages in regard to the ease and accuracy of registry and calculation. Unfortunately, owing to the British tendency to do so many things by dozens and their multiples, we are saddled with a 60-min. hour. It is too much to hope for a change to an hour of 100 min. We can, however, divide this unit into ten periods of 6 min. each and we will find this division more convenient and certain than a division of quarters. Just to prove this assertion, suppose we try for one day, dividing our dollar into sixty equal parts, and see how disgusted we get. Yet that is just as rational as using a 60-min. hour.

Every worker who stands around waiting for work, tools, power, instructions or repairs, is a loss to the establishment, and sometimes he is a loser as well. The excuse may be a lack of orders or bad planning; but the main thing is to record all such idle periods and to try to eliminate future occurrences from the same cause. An idle workman is apt to instill idleness in others, but human nature cannot be eliminated.

Some pieces of equipment "made good" from the very date of their installation, while others are a source of trouble and even of loss, either because they are unsuited to the class of work, are too small or too large, or are of a character that demands a different class of operatives from that which is available. Many a printing office is in this predicament because it has too large a press and, in consequence one that is too slow for the average work. This compels the printer to ask an unobtainable price for press work on all jobs that could be done economically and profitably on a smaller machine.

This being so, there should be for each piece of equipment, a card on which are entered all the data that are likely to be useful in determining what classes and sizes of work the equipment is capable of turning out, and what it is not able to do; what parts are constantly giving way or wearing out, and hence need frequent replacement; what class of operatives is the most suitable; the amount of power, gas or water required; and whether or not the piece is likely to be obsolescent or obsolete at an early date.

Sticking to Commercial Sizes

BY C. E. JENSEN

There are many instances in which a designer has more or less thoroughly handicapped the production department by introducing special dimensions, shapes or materials, that, for all practical purposes, might just as well have been the standards which are found anywhere on the market, or are readily and cheaply manufactured. It may be that a shaft $2\frac{7}{8}$ in. in diameter would be exactly strong enough for a given transmission. If this sized shaft, however, would cost more than the usual $2\frac{15}{16}$-in. shaft, it would be folly to suggest, much less insist upon, the use of the $2\frac{7}{8}$ in.-size just because it was technically exact.

Methods of Machine Tool Design

Fifth Part of the Chapter on Gear Drives—Pull-Pin Speed Variators and Their Action—Change Gears—How to Get Odd Ratios

By A. L. De LEEUW
Consulting Editor, *American Machinist*

PULL-PIN gears are not used to any great extent, but were, at one time, one of the best known means to obtain variable speed. At the present time, a description of a set of pull-pin gears is of not much more than historical value, and will therefore be abbreviated. Fig. 104 shows the standard construction of a set of three pull-pin gears. The gears *A*, *B* and *C* mesh with *D*, *E* and *F* respectively. The latter three gears are keyed to their shaft, whereas the former run loose. For the same reason that it is advisable to have the keyed-on gears of a clutch system as driving mem-

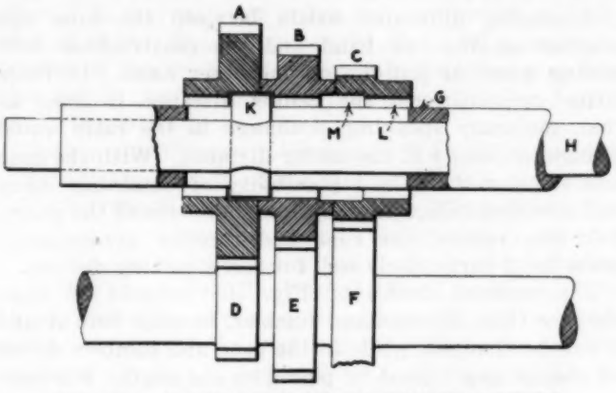


FIG. 104—THREE-SPEED PULL-PIN GEARSHIFT

ber, it is advisable here to drive with gears *D*, *E* and *F*.

The gears *A*, *B* and *C* are running loose on a shaft *G*. They are kept from sidewise movement either by collars on that shaft or by adjacent bearings. A hole is bored through the shaft, in which slides rod *H*, which is provided with a cross-key *K*. The gears have keyways *L* and are counterbored at *M* to a size slightly larger than the depth of the keyway and to a combined width slightly more than the width of the key. This counterbore may be all in one gear, or it may be divided between the two adjoining gears. It is merely a place where the key can go without engaging either gear, so that it is possible by the endwise movement of the rod *H* to pull the key out of one gear and have it in a

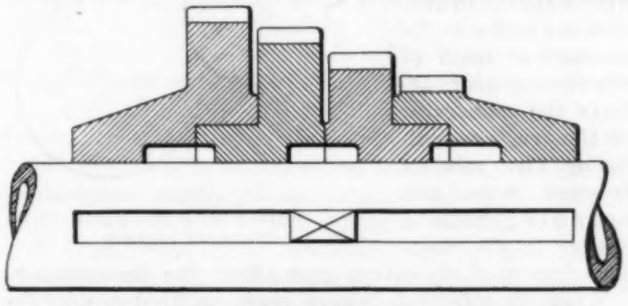


FIG. 105—CONSTRUCTION TO INCREASE LENGTH OF GEAR BEARING

neutral place before it enters another. A slot is made in shaft *G*, in which the key *K* can slide. It will be noticed that the key projects on both sides of the shaft, so that it is double acting.

The disadvantages of such a system are evident. There are gears running loose on a shaft, requiring positive means for lubrication, and yet the keyways in the gears and the slots in the shafts make such lubrication almost impossible, so that such gears are confined to light loads and low speeds.

In order to have a sufficient length of engagement between keyway and key the gears must be of considerable length on the shaft. As a matter of fact, the total length of the three gears shown on the shaft must be more than five times the width of key *K*. Even at that, the amount of bearing on the shaft is small.

In order to increase the possible amount of bearing on the shaft without having the gears themselves too far apart, a construction such as shown in Fig. 105 may be made, in which four gears are shown side by side, but of which the hubs are so constructed that a considerable length on the shaft is possible.

In ordinary construction the rod *H* projected through one end of the shaft and was there provided either with a knob to be operated by the fingers of the operator, or else with a special collar which might be operated by a lever. This construction is shown in Fig. 106, in

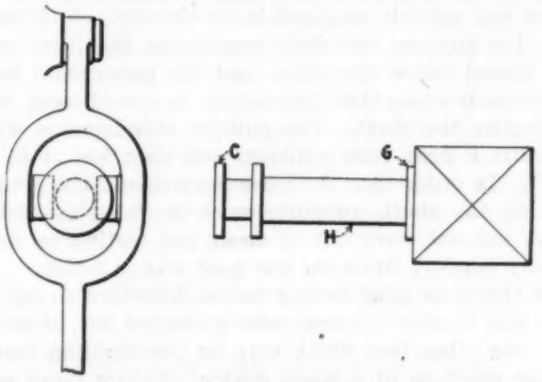


FIG. 106—COLLARS AND YOKE AT END OF PULL-PIN

which rod *H*, shaft *G* and spool *C* are shown. The end view shows how such a spool may be operated by a lever.

The projecting part of the pull rod may become excessively long when there are many gears in the system or when they have long hubs. Such a long projecting part of the pull rod is unsightly and is apt to be bent accidentally whether it is operated by hand or by lever. To avoid this, the construction shown takes the form shown in Fig. 107 where another slot in the shaft permits a cross pin to connect the pull rod with the spool before leaving the shaft. Of course, this construction is not always possible. It requires additional available length of shaft. It hardly needs to be pointed out that the shaft is still further weakened by this construction.

The pull-pin arrangement is modified in different ways. In one construction each gear is provided with two hinged keys, opposite each other (just as the construction described in the previous paragraph had two opposite keyways). There is a spring pressing on the back of each key, tending to force it into the groove

or slot of the shaft. The pull rod itself prevents this. This rod is provided with a key completely filling the slot in the shaft except for a few notches or impressions in this key. If one of these notches came opposite the projecting part of one of the keys, that key would drop and cause the shaft to engage the gear. The notches were so placed that only one at a time could correspond to the projection of a key while another would become active as soon as the previous one had passed. In that manner the amount of travel of the rod was limited to a little more than the combined lengths of the projections of the key, regardless of the lengths of the hubs of the gears.

Finally, to show how hard machine tool designers were striving for means to obtain variable speed by

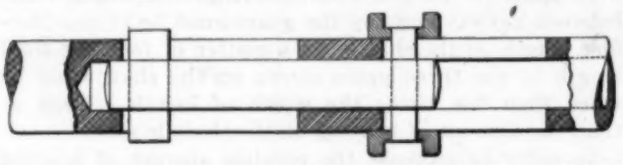


FIG. 107—PULL-PIN ARRANGEMENT TO AVOID BENDING

gearing and how, in their eagerness, they forgot everything except the one object they had in view, a short description will be given here of a variable speed gear device brought out by a reputable machine tool builder some twenty years ago. The device consisted of two cones of gears. One cone was keyed to a shaft, while the other consisted of gears which would revolve on the shaft and which could be coupled to it by a pull-pin device. To avoid the running of idle gears, all loose gears not actively engaged were thrown out of mesh. For this purpose the shaft containing the loose gears was placed below the other, and the gears were bored out to such a size that they would be out of mesh when resting on the shaft. The pull-pin arrangement would first lift a gear into position, and then key it to the shaft. In order that the loose gear should not actually rest on the shaft, supports were provided so that all gears but one were out of mesh and resting on a stationary support while the one gear was in action.

Of the three gear arrangements described so far, the cone and tumbler arrangement possesses one advantage over the other two which may be the deciding feature in the selection of a speed device. Before rapid speed changing devices were employed, simple change gears were used for the purpose. They were used either on fixed or on movable centers. The segment in the feed mechanism of a lathe or the spiral gear driving attachment for the dividing head of a milling machine are instances of the use of change gears with movable centers.

Change gears with fixed centers are found on many special machines or on machines where speeds have to be changed at infrequent intervals only. They are not often found in feed mechanisms. The reason is that many feed mechanisms require a fixed relation to the spindle feed. In the mechanisms mentioned (lathe and dividing head) a certain lead must be produced so that it becomes imperative to select change gears with a given ratio. This is not always possible; in fact it is but seldom possible with fixed centers. If, for instance, there are two change gears meshing with each other, each of 40 teeth, the sum of the numbers of teeth of any two gears placed on these centers must be 80, and if the smaller gear cannot be made with less than 20 teeth, on account of size of shaft or other existing conditions, the following combinations would be possible: 20—60; 21—59; 22—58; 23—57; etc. As will be seen, most of the ratios are odd fractions, fractions which are not likely to occur in our calculations. The ratios which we would be able to obtain and which could be expressed by small numbers are: 20—60 (1 to 3); 24—56 (3 to 7); 25—55 (5 to 11); 30—50 (3 to 5); 32—48 (2 to 3); 35—45 (7 to 9); 40—40 (1 to 1); and the inverted values of these fractions. Such an arrangement would not be satisfactory for screw cutting or any other device which would have to produce a variety of leads.

The arrangement with movable centers, on the other hand, allows of many leads. Fig. 108 shows in diagrammatic form the well-known segment construction. The idler makes it possible to obtain any desired ratio between *A* and *B*.

Flexibility of Cone and Tumbler

A similar difference exists between the cone and tumbler on the one hand and the construction with sliding gears or pull-pin on the other hand. In these latter constructions, the center distance is fixed so that, generally speaking, a change in the ratio would demand a change in the center distance. With the cone and tumbler there is a possibility of obtaining many ratios without changing anything but some of the gears. For this reason, the cone and tumbler arrangement lends itself particularly well for screw cutting devices.

The segment device of Fig. 108 permits of more changes than the cone and tumbler, because both *A* and *B* can be changed, while in the cone and tumbler device all change gears must be placed on one shaft. Furthermore, so far as the possible gear ratios are concerned, it makes no difference whether we swing the idler around *A* or *B* as center. With the cone and tumbler device, it does make a difference whether the cone shaft is the driven shaft or the driver. If we should want the feed screw of a lathe to make 2, 3 or 4 revolutions for each revolution of the spindle, we would have to put gears of $2n$, $3n$ or $4n$ teeth on the cone shaft and make it the driver. If, on the other hand, we should want the screw to make $\frac{1}{2}$, $\frac{1}{3}$ or $\frac{1}{4}$ revolution per revolution of the spindle, we would again place gears with $2n$, $3n$ or $4n$ teeth on the cone shaft, but make it the driven shaft. In general, a change in the number of teeth of the driving gears affects the numerator of the fraction indicating the relation between screw and spindle; while a change in the number of teeth of the driven gear affects the denominator.

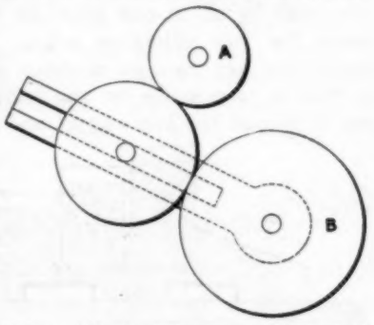


FIG. 108—SEGMENT CONSTRUCTION FOR MOUNTING CHANGE GEARS

When we said that change gears on fixed centers do not permit of a free selection of gear ratios, we took silently for granted that standard spur gears were to be used. However, when we are confronted with the necessity of retaining an existing center distance, we may increase the list of possible combinations very materially by making use of the well-known fact that

involute gears may be placed closer together or further apart than their theoretical center distance without affecting their proper running. Furthermore, it is possible to cut spur gears with involute teeth on the Fellows gear shaper or by similar generating processes which will run properly, though the fixed diameter is not equal to the number of teeth divided by the pitch. The following illustration will show how these peculiarities can be applied in practice:

Center distance.....5 inches
Pitch of gears.....8 inches

From this we find that the sum of the number of teeth of the two gears is: $2 \times 5 \times 8 = 80$. In order to find two gears of which the ratio is a to b, we would divide 80 by $(a + b)$, and multiply the quotient by a for gear A, and by b for gear B.

If we take for granted that the ratio of a and b has been reduced to its simplest form, then 80 must be divisible by $(a + b)$ if a set of gears shall be possible with the desired ratio. As 80 can be divided by 2, 4, 5, 8, 10, 20 and 40, any ratio of which the sum of the terms is one of these divisors might be had. However, the smaller of the two gears cannot be made below a certain size, let us say 20 teeth, so that 60 and 20, or 3 to 1, is the largest ratio we can obtain.

Taking the divisor 2, we find that 1 to 1 is possible.
Taking the divisor 4, we find that 1 to 3 is possible.
Taking the divisor 5, we find that 2 to 3 is possible.
Taking the divisor 8, we find that 3 to 5 is possible.
Taking the divisor 10, we find that 3 to 7 is possible.
Taking the divisor 20, we find that 7 to 13, and 9 to 11 are possible. Besides, we can make any ratio of which the sum of the terms is 80, such as 37 and 43, or 23 and 57, etc. If, however, we should meet a ratio of which the sum of the terms is 7 (such as 3 to 4), we would not be able to find two gears of that ratio and of which the sum of the numbers of teeth is 80. We could find gears with a combined number of teeth of 77 or 84. If we take 77 as the sum, the two gears will be 33 and 44. By taking two blanks of the proper diameter for 34 and 46 teeth (note that $34 + 46 = 80$), and cutting them with 33 and 44 teeth, we meet the requirements. If we had selected 84 as the sum, we would have to make the gears with 36 and 48 teeth, cut on blanks of the proper diameter for 34 and 46 teeth. This little artifice can often be profitably applied.

Even if it is not possible to reach a solution in this manner, there is another way of overcoming the difficulty. A helical gear of n teeth, and with a spiral angle α, has the same diameter as a spur gear of n sec. α teeth. If, then, we wish to find two gears with a ratio of 3 to 4, all we have to do is to give them m and n teeth and a spiral angle α so that $n:m::3:4$, and so that

$$(n + m) \text{ sec. } \alpha = 80$$

As sec. α is always more than 1, we must make $n + m < 80$. We could have selected 77 but not 84. We would find sec. $\alpha = 80/77$. We might have selected a smaller number than 77, and we would have found a correspondingly larger value for α. However, it is well to keep the value of α as small as possible; in other words, to keep $n + m$ as near to 80 as possible to avoid the objectionable effects of end thrust due to the spiral angle.

What was said about change gears applies equally well to sliding gears and pull-pin gears. These latter could be arranged as helical gears, but the sliding gears do not lend themselves to this treatment.

Industrial Relations and the Construction Industry

BY ERNEST T. TRIGG

The whole question of "industrial relations," as we have come to call it, is one of the most important and fundamental problems confronting the entire world today. I do believe that there are unmistakable signs indicating a better understanding of the situation and a clearer realization of the responsibilities on both sides than has heretofore existed. Really, the problem is one which I have always preferred to think of in terms of "human relations" rather than "industrial relations," because it is essentially a matter of relationship between man and man—a distinctly human proposition. The great economic loss which we are called upon to stand every year because of disputes between employers and employees, is a bill which the public, as an innocent bystander, has to pay.

It does seem so utterly foolish and unnecessary and could so easily be avoided by proper understanding between the employer and the employee, of the problems, the viewpoints and the necessities of each by the other. The employer is, undoubtedly, the one who should assume the leadership of, and keep the human touch with, his own group of workmen. Unfortunately all employers do not do so and so long as they vacate this position, just so long will there be room for interference in their mutual affairs by third parties who so often are the root of the trouble. Employers are not entirely blameless in the situation. Education of the employers as to their responsibilities and duties is, in my opinion, quite as essential as the education of the employees.

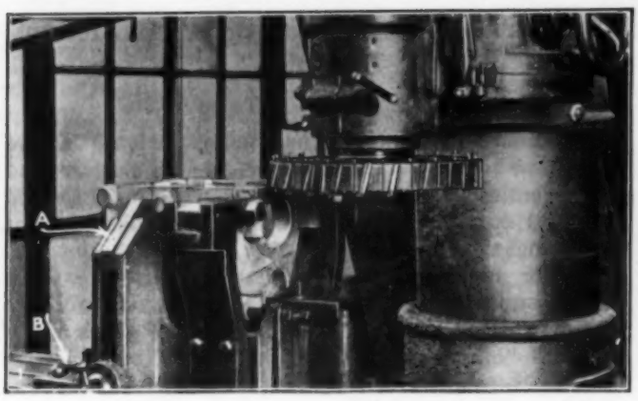
It is the employer's responsibility, for one thing, to see to it that in times of depression, when there are fewer jobs than there are men, the wage of the workingman is not cut down below the living point; on the other hand, the employee should realize that there is a point over which the wage rate cannot successfully go if our industries are to continue to thrive and the wheels in our factories to go round.

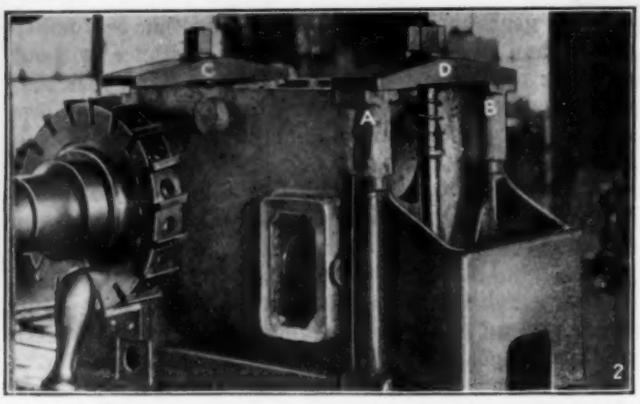
From a paper presented at a recent meeting of the National Paint, Oil and Varnish Association, by its president.

Safety Work at the Ford Plant

The Ford Motor Co. recently had an intensive safety week campaign which produced astonishing results. The week's output of 30,972 cars by 46,627 workers was without a single major accident, and minor accidents were reduced one half. Four accidents involved the loss of 1 day each, three of 2 days each, two of 4 days each, one of 5 days, two of 6 days, four of 7 days and one each of 10 and 14 days. This makes a total of eighteen cases and 87 days lost time out of a total of 276,000 days worked.

Every department holds instruction meetings on the hazards of work, shows what has caused and can cause accidents and gives suggestions as to how to avoid injury. These instruction meetings are, in the future, to be held on the first work day of each month. Several departments such as the "drop forge" and "body pressed steel" went through the week without a single lost time accident. The factory paint department, which has a lot of hazardous work such as painting smoke stacks and other scaffold work has a record of forty-six consecutive months without a lost-time accident.





Machining Pierce-Arrow Transmission Cases

BY FRED H. COLVIN
Editor, *American Machinist*

THE transmission case of the Pierce-Arrow car is of aluminum, as is usual; and in order to positively remove all sand and loose metal the inside of the case is thoroughly scraped and filed before going to the preliminary machining operation, which is milling the face of the joint surface.

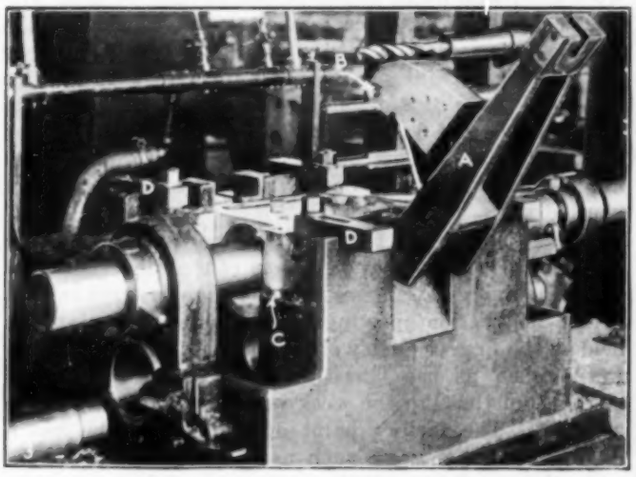
The facing of the lower half of the case is shown in Fig. 1, being done on a Brown & Sharpe vertical milling machine. Provision is made for clamping the case without springing it, the different jaws being so designed as to have a good bearing surface and to avoid distortion. Jaw *A* and its mate on the opposite side are operated by handle *B*. An inspection of 10 per cent of the work follows this operation, after which the other surfaces are milled. Particular attention is paid to keeping everything square and parallel, the tolerance for the latter being 0.005 in.

Then come two profiling operations, after which the surface for the handhole cover is milled as shown in Fig. 2. This view shows how the case is supported by the substantial end lugs at *A* and *B*, the other end being held in a similar manner. This construction makes clamping particularly easy, as the straps *C* and *D* can be handled very quickly and the case lifted either in or out.

Several drilling and tapping operations follow, after which the two halves are mated and numbered and the drain hole laid out in the bottom half. The inspection department watches the numbering very carefully to be sure that no errors creep in at this point. All bolt and dowel holes are then transferred to the bottom half of the case through the top half and the drain hole is drilled, faced and tapped. The parts are then mounted together, the level working-base scraped to a bearing and the holes bored both for the bearings and the shifting rod housing. The hole for the idler gear is next bored and faced, allowing 0.01 in. on the outside face of the boss. A 10 per cent inspection takes place at this point.

The boring of the holes is shown in Fig. 3, which gives a good idea of the construction of the fixture and shows the swinging arm *A*, carrying the guide bushing *B* for the idler-hole boring bar. This view shows how the work is located on the hardened steel buttons, as at *C*, and held in place by the sliding clamps, as at *D*.

The transmission case is then mounted on a mandrel as shown in Fig. 4, both ends are faced and the outside diameter of the large boss extension is turned. This leaves only some counter-boring and the chipping of such clearance for shifting leaves as may be necessary, after which the case is studded and put together ready for inspection before going to assembly. The numbers of any cases scrapped are reported to the inspection room for record.



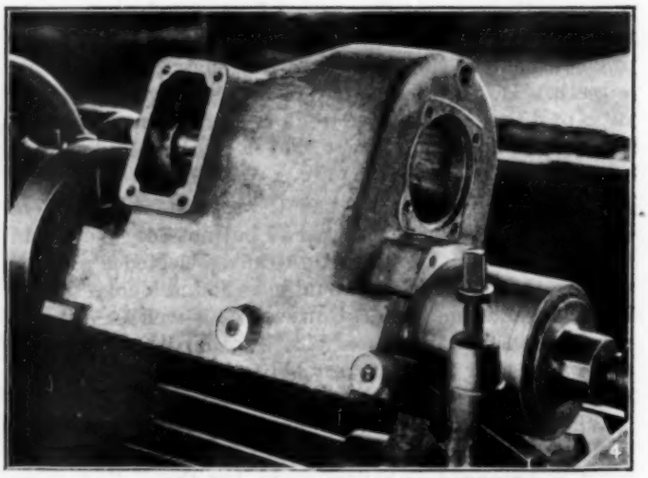
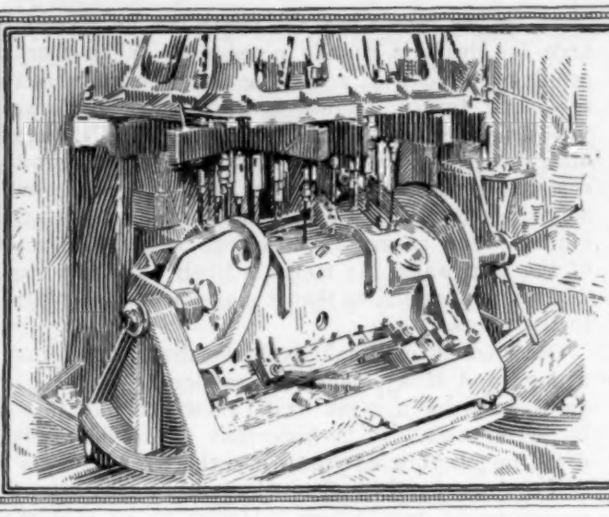


FIG. 1—MILLING THE CASE JOINT. FIG. 2—MILLING FOR HAND HOLE COVER PLATE. FIG. 3—BORING FOR THE SHAFT BEARING. FIG. 4—TURNING THE ENDS AND FACING



Tool Engineering

By
Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Dowd Engineering Company, New York City

Design of Drop-Forging Dies—General Practice and Important Points—Draft and Machining Allowances—Proportions of Parts of Die-Blocks

HERETOFORE we have discussed fixtures and tools used in the various processes of cutting metals. The tool engineer who is progressive and wishes to become thoroughly familiar with the entire subject, must also understand both principles and details which apply to the bending and shaping of different metals either hot or cold. In discussing matters which pertain to the subject we shall consider first the tools used for forging various shapes.

It is interesting to recall briefly the growth of drop forging and the adoption of forgings in place of castings for many purposes. Some years ago the practice of drop forging was limited to small work of a comparatively simple nature; but during the development stages of the bicycle more elaborate designs were made, although even at this time the parts were of comparatively small size. With the development of the automobile it was found that castings were unsuited to use for many of the parts; hence a distinct advance was recorded in the process of drop forging, which was developed to cover a much wider field and more complicated work. The use of alloy steels of different kinds and special steel for die-blocks has been an additional improvement in the process.

Drop forgings can be produced more cheaply than castings in many cases, and they have replaced the latter for many purposes. Greater difficulty is found in the forging of alloy steels and those containing a high percentage of carbon, and more care must be used when designing dies to avoid sharp points and projections or deep impressions, as it is sometimes difficult to fill the dies when forging alloy steels. It is not our purpose to go into details in regard to the process of drop forging, but a certain amount of information is necessary to enable the tool designer to understand the principles which effect the design of dies.

The simplest form of drop hammer used for forging is the "board-drop" type having a hammer of not more than 2,000 lb. striking weight. For small forgings such as wrenches, turnbuckles, rod-ends and eyebolts, this type of hammer is thoroughly efficient. When heavy forgings are to be handled, however, steam hammers are required. In making a selection of the hammer for use in producing a given drop forging, the size of the work is not always a determining factor, although it has some effect on the selection. It is usually better to select a hammer too large than one which is too small for a certain class of work. The general inclination is toward the use of steam drop hammers, particularly in the automobile industry.

It is customary to work up the forging from short lengths of bar stock rather than to cut the stock into blanks approximating the size of the work to be done. The length which is found to be most convenient for handling ranges from 3 to 5 ft. The bars are first set in the furnace, and after properly heating at one end they are removed to the dies and the forgings produced by the action of the hammer. This procedure continues until the bar is too short to be handled with the tongs. On small forgings it is often possible to produce two parts with one heating of the bar, but on larger work the stock must be heated after each operation.

Accurate forgings can be produced only when proper consideration has been given to the shrinkage of the metal. When work is of such a nature that two heavy ends are connected by a thin strap, the shrinkage is likely to be much greater than when sections of the work are more nearly uniform. A certain amount of variation is to be expected in drop forging practice, but careful design of dies will minimize this and keep it within reasonable limits.

A set of dies used for drop forging consists of two steel blocks, each of which contains an impression of one-half of the forging which is to be produced. One of the dies is attached to the ram of the hammer while the other is mounted and secured on the sow block or anvil cap. Suitable matching surfaces are provided for aligning the upper and lower dies, so that the impressions will join each other properly. Dies are made of cast steel occasionally, but this material is not recommended unless the design of the forging is such that the impressions must be cast in it. There is, of course, a great saving in the course of manufacture when cast steel dies are used, but they are not as serviceable as those cut from the solid metal.

The development of the automatic die-sinking ma-

chine has simplified the manufacture of dies to such an extent that cast steel is not used as much as it was a few years ago, except on very large work. This automatic method of machining dies uses a wood or plaster model as a master. The master is provided with the necessary flash and gutter, and a follower goes over the entire surface while a cutter suitably situated reproduces the form in the die. An immense amount of hand work is saved by the use of machines of this type, so that the cost of die work has been very materially reduced.

The use of cast iron for a light class of forging

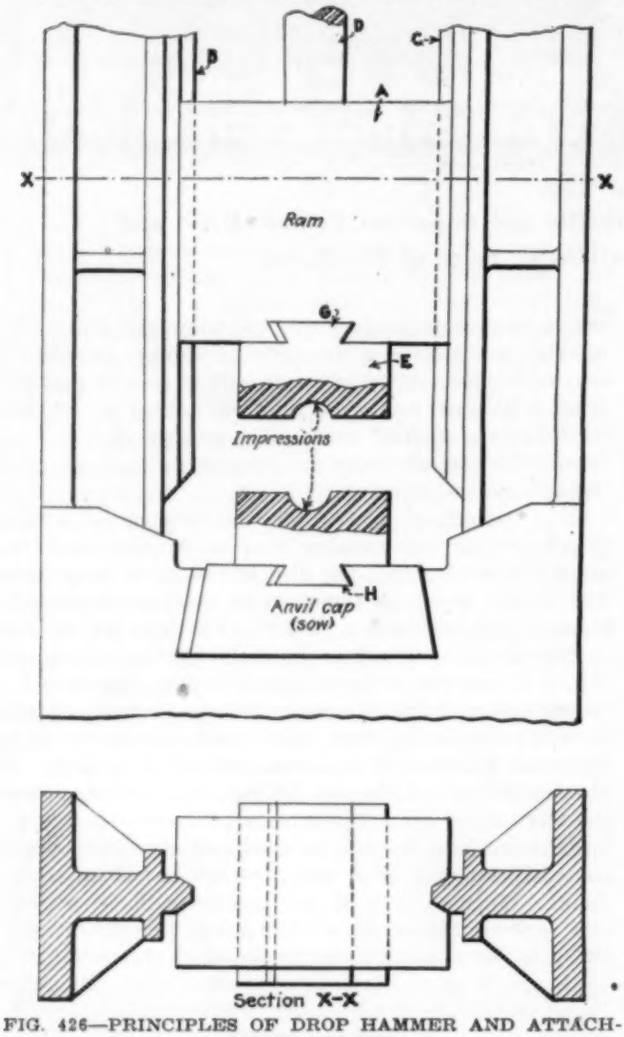


FIG. 426—PRINCIPLES OF DROP HAMMER AND ATTACHMENT OF DIES

dies has been successful to some extent, particularly when only a few parts are to be manufactured. They can be made cheaply and will answer the purpose for some conditions. Only the finest grain of iron should be used for the purpose. All of the points mentioned here are of interest to the designer in order that he may select the proper material to be used in the manufacture of the dies.

After the size and material of a die-block have been determined, the draft allowance, shrinkage and machining allowances must be considered. The ordinary allowance for draft is 7 deg., but in certain cases this is increased to 10 deg. or even to as much as 15 deg. when the depth of the impression is excessive, or if other things in the general design make it necessary. For narrow and deep forgings when the metal must be "shot up" or forced into the upper die, an extra allowance for draft is usually necessary. When there are openings or holes in a forging and when thin sections are being forged, increased draft must be allowed.

When plugs are used for producing holes in matched dies, these plugs are made of such a height that there remains a thin wall in the forging, which web is subsequently punched out. The draft on plugs of this kind is often as great as 15 deg. because, on account of the thin walls, the metal is likely to shrink rapidly during the forging, so that it may contract and "freeze" to the plugs.

Occasionally on small work the draft is as small as 3 deg., and if a shallow impression is required even on large work a small draft allowance like this may be permissible. It is important to provide sufficient draft on all forging work, as otherwise the dies will deteriorate rapidly and break down, so that it will be necessary to recut them. Unless there is sufficient draft, there is a greater likelihood of breakage in forging.

Allowance for Machining

The allowance necessary for machining a given surface must be taken into consideration in the design of the die and sufficient metal left at the points required. The amount of metal allowed for finishing is different in various factories. Many places allow at least $\frac{1}{32}$ in. on small work, while on larger pieces $\frac{1}{16}$ in. is made. On long work which requires accurate machining of length, it may even be necessary to make a finish allowance of $\frac{1}{32}$ to $\frac{1}{8}$ in. Finish allowances should always be made in addition to the allowance for draft.

Some companies have established a method of making forging drawings of full size on each part which is to be manufactured. On this drawing the allowance for draft, machining, etc., is shown, and the outline of the finished part is shown by dotted lines. When forgings are made outside the factory, blueprints of the drawing may be sent to the firm that is to make the forging and any changes which may be found necessary can be suitably marked on the blueprint and returned for approval. This practice is to be commended, yet it is not generally followed, as a considerable knowledge of drop forging is required in order to make the drawings properly. A request may be made of the drop forging company to furnish blueprints or drawings showing the finished allowances, draft, etc., which it proposes to furnish, and any desired changes can be marked on the print at the time of its approval.

There are a number of other points in connection with the design of drop-forging dies and general practice in regard to forging which will be taken up in detail later in this article. The intention has been so far to familiarize the designer somewhat with the general process and give him a few details so that he will obtain a clearer understanding of the general requirements.

Important Points

In considering the matter of dies for a given piece of work, there are a number of points which we will mention in a general way and then take them up in detail later by means of graphic examples. Let us assume that drop-forging dies are to be made for a piece of work; certain information will be found necessary before proceeding with the design.

(1) Number of Parts Required: This affects the dies to a great extent and determines whether they will be of cast iron or steel. A small number of parts might be made in cast-iron dies, while a large number would require the use of steel.

(2) Samples: If a new die is required for an old part there may be a sample available from the old die. This can often be used to obtain an idea of the method previously utilized, providing that the sample is in good condition.

(3) Templets: If there are templets for the dovetail and edges or breaker, or if it is possible to obtain

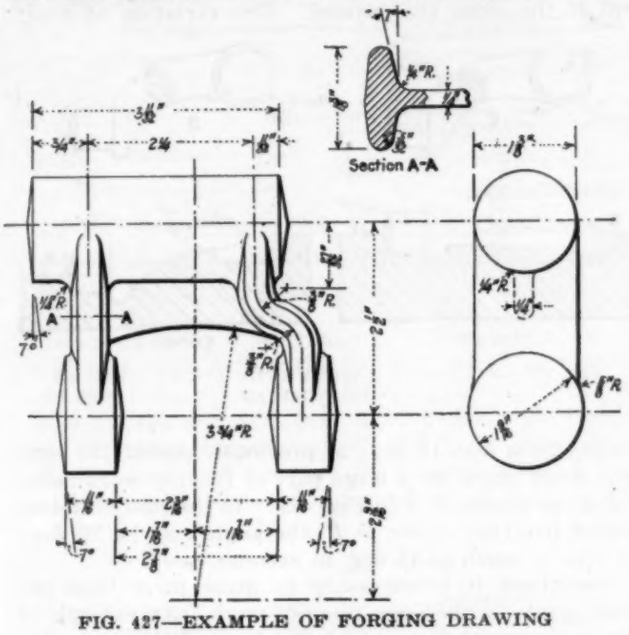


FIG. 427—EXAMPLE OF FORGING DRAWING

those which were originally used for impressions, all of these things will help in the design and manufacture of a new die. Where fullers have been used, a templet may be available for this also. The templet will show the amount of stock which was found sufficient for the needs of the die. If there was a layout of the dies when they were originally made, a reference to this will be a great help; and if accurate drawings can be found, it will obviate the necessity for new ones.

(4) Finished and Forging Drawings: A great deal depends on the nature of the work and whether the part has been previously made or not. In either case, however, a forging drawing is the starting point from which the dies should be developed. It is necessary that a very practical man who understands the process of forging well should be given this work, as otherwise draft allowances and other important matters will not be properly taken care of.

(5) Shanks: The sizes of shanks should be given for the hammer to which the dies are to be fitted. The various dimensions required are: (*a*) width, (*b*) depth, (*c*) angle, (*d*) round corner and (*e*) off set or center.

(6) Type of Lock: A determination should be made as to whether a plain lock will be all that is needed, or whether a counterlock is required. These points will be brought out later in the article.

(7) Draft Angle: The draft angle may be anywhere from 3 to 15 deg., depending on the nature of the work. It is only necessary to make sure that the angle is sufficient so that the work will not stick.

(8) Finish: The allowance for finish is important and should be decided upon and approved before any work has been done on the die.

(9) Other Important Points: Such matters as the match edge, the flash, the gutter, together with its width and depth, and various other points must all be considered in the design.

(10) Tolerance: The amount of tolerance permitted on the forging has a decided effect upon the layout of the work. Certain kinds of steel shrink more than others, and certain forms of forgings require a greater shrinkage allowance than others. These points are determined largely by experience, although it may be generally stated that work having heavy ends and a thin connecting section will require a greater shrinkage allowance than those forgings which are of uniform section. Various other matters connected with die design will be mentioned specifically during the progress of this and the subsequent article.

Attachment of Dies

In Fig. 426 is shown a diagram of a portion of a drop hammer with dies in position in order to illustrate the principles used in forging. A ram *A* slides up and down on the ways *B* and *C*. The shaft *D* is connected with the piston of the hammer when the steam-hammer type is used. For the "board-drop" type a different connection is made, but it is unnecessary to go into detail regarding this matter. The dies are usually spoken of as the upper and lower impressions, as indicated at *E* and *F*. The upper impression fits the dovetail *G* of the ram and moves up and down with it. The lower impression *F* is dovetailed at *H* to fit the anvil cap or sow. The dies are fitted to each member so that they register accurately one with another. The section *X-X* gives an idea of the general appearance of the ram and side columns of the hammer.

We have previously mentioned the importance of having a forging drawing made for each piece which is to be drop forged, and in order to illustrate the manner in which these drawings are made, an example of

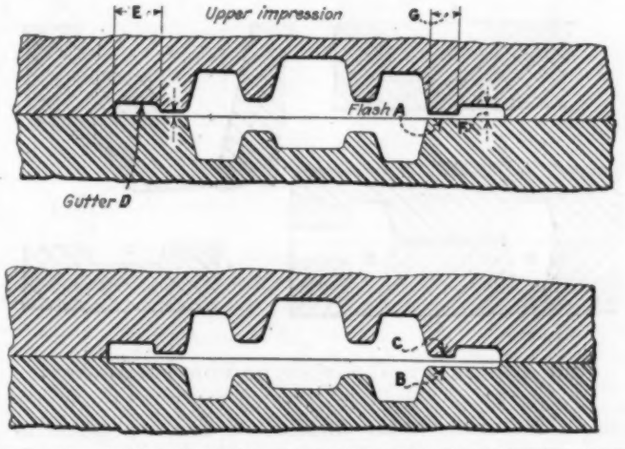


FIG. 428—SECTIONAL VIEW OF UPPER AND LOWER DIES

one is shown in Fig. 427. Attention is called to the care with which all center lines are located so that there is no guess-work about the positions of the various centers used in the construction. A sectional view is given at *A-A* so that the die maker will understand the form at this point. All draft angles are shown, and a suitable allowance has been made for

finishing so that sufficient stock is allowed to permit the work to be machined to the dimensions of the finished drawing. We have considered it unnecessary to show a finished drawing of the part, as we are not concerned with the machining of the work at present.

Important Features of Dies

It is our intention to illustrate the important points in die design by means of graphic examples in order to familiarize the designer with the uses and names of the various parts of a die. Fig. 428 is a sectional view of upper and lower dies, showing the "gutter" and "flash." The purpose of the flash is to allow the metal to flow out slightly beyond the edges of the forging, so that only a thin wall remains which can be trimmed off very easily in a trimming press after the forging has been made. The flash may be entirely in the upper die, as shown at *A*, or it may be half in the upper die and half in the lower, as shown at *B* and *C*. The simplest way of making it is in the upper die entirely, although circumstances alter cases and there may be times when it would be found an advantage to make it in both impressions.

The gutter *D* is an important feature in the design of die, as it is intended to take the overflow from the die in excess of that which lies in the flash. It is necessary always to provide a gutter all around the work, so that there will never be any possibility of the metal being compressed without having an outlet in the event that the stock which is being forged is a little too large. This circumstance would cause a breakage in the hammer or dies or other troubles, unless the gutter was provided. A gutter may be considered in very much the same manner as a safety valve on a boiler, as it relieves excessive pressures in the die. It is important to have a gutter sufficiently large to take care of any extraordinary condition which may develop when forging, so that the width *E* and depth *F* should be great enough to provide for any emergency. Naturally these dimensions are dependent to some extent upon the size of the die and the amount of metal which is being forged.

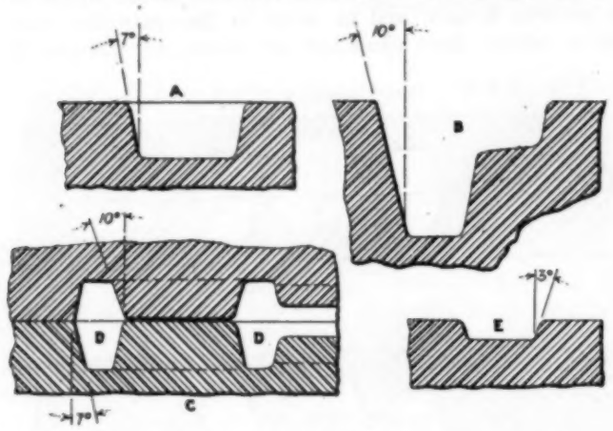


FIG. 429—DRAFT ALLOWANCES FOR FORGINGS

Large dies need more gutter space than small ones, as much more metal is being worked. The flash *A* is generally quite thin, as this makes it easier for the trimming dies. The distance *G* is also dependent upon the size of the die and the work which is being done. Although both the flash and gutter may appear to be rather unimportant points in the design of dies, this is really not the case, for a lack of proper provision for these matters would cause a great deal of trouble. It seems best to call particular attention to them both by means of the diagram shown.

Draft Allowances

The allowance for draft on forgings is dependent almost entirely on the depth of the impression. The purpose of the draft is to prevent the work from sticking in the die after the forging has been made. Another point of importance is the fact that the metal will flow more readily into an angular pocket than it will if the sides are parallel. The variation in draft ranges from 3 to 15 deg., as previously stated, the common draft angle for a large part of forging work being 7 deg., as shown at *A* in Fig. 429. In the case of a deep pocket like that shown at *B*, the angle may be 10 deg., or even as much as 15 deg. in extreme cases.

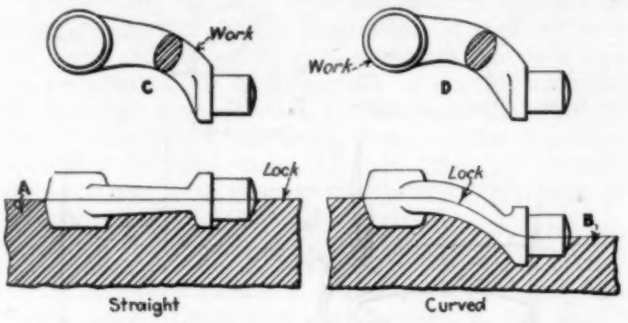


FIG. 430—STRAIGHT AND CURVED LOCKS USED IN FORGING DIES

Sometimes it is necessary to make more than one draft angle on the same piece of work. An example of this is shown at *C*, in which the forging has a circular boss at one end, a section of which is shown at *D*. Here the outside angle of the boss might be made 7 deg., but the upper and lower plugs or inside angle would need to be 10 deg. or more so that they would not tend to stick in the work. For small work and shallow forgings, a 3-deg. angle is sometimes used like that shown at *E*. The fact that the work is shallow makes it possible to use a very acute angle on work of this sort, as there is little danger of sticking and the depth is so small that the metal will flow into the impression readily.

The lock in die work is really the parting line which separates the upper and lower impressions. Locks are made straight or curved, depending on the nature of the work which is to be forged. The method used and the position of the piece which is to be made affect the shape of the lock to a considerable extent. The examples at *C* and *D* in Fig. 430 illustrate two different methods by means of which the same work can be forged. This diagram also shows the difference in the lock which arises from the method of forging.

In the sectional view at *A* the work is forged flat, so that the lock is perfectly straight and both upper and lower halves contain the same amount of metal. In the example *B* the forging is made in another position which necessitates making the lock on a curve. In some cases the shape of the piece may require quite an irregular lock; but, if other things are equal and results can be obtained as well in one way as in another, the straight lock is to be preferred because it is easier to make.

The Art of Milling in 1750

By L. L. Thwing

Some time ago the writer ventured to predict that if the inventor of milling cutters—and milling machines—was ever located, that he would be a watch or clock maker, and probably a French clock maker. Since that time certain information has been secured which seems

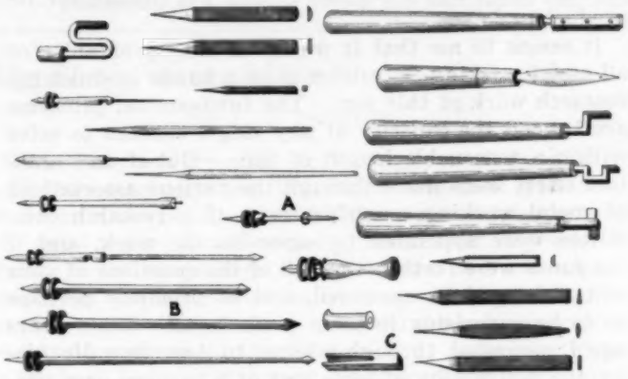


FIG. 1—FRENCH CLOCKMAKER'S TOOLS

to substantiate this prophecy. The French Encyclopedia of 1752 defines the word "Fraise" as a tool or process common to many trades, and continues "it is also a small circular plate of hard tempered steel, cut on the circumference. It is used to cut the teeth in clock gears. Also a sort of 'rochet' mounted on an arbor to make slots for the 'rochets' of the chain."

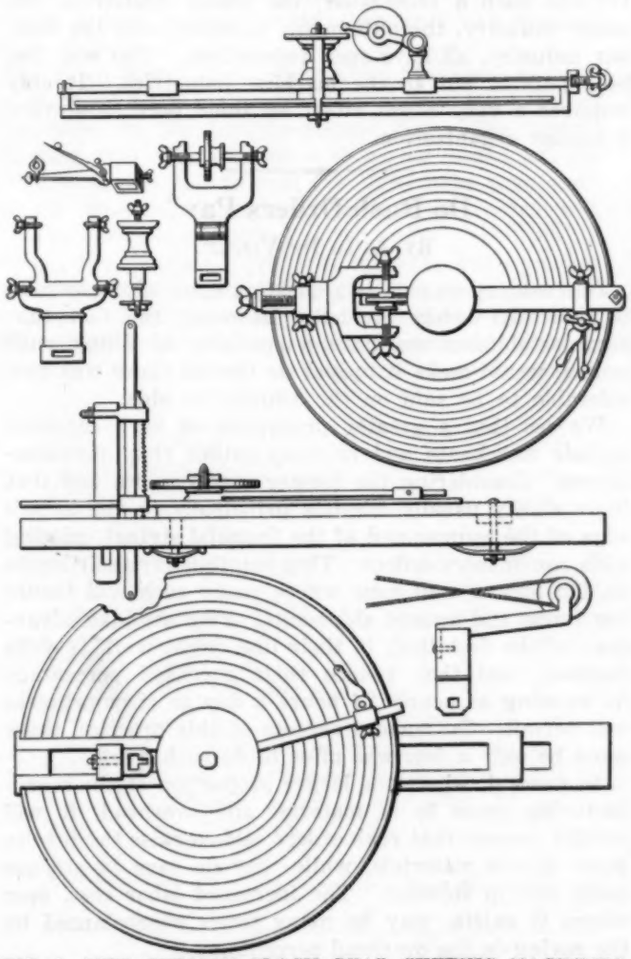
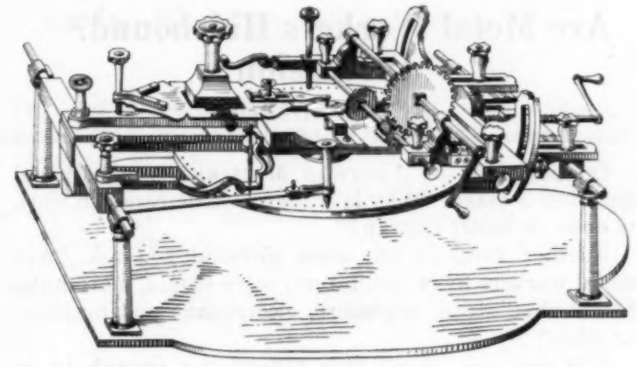
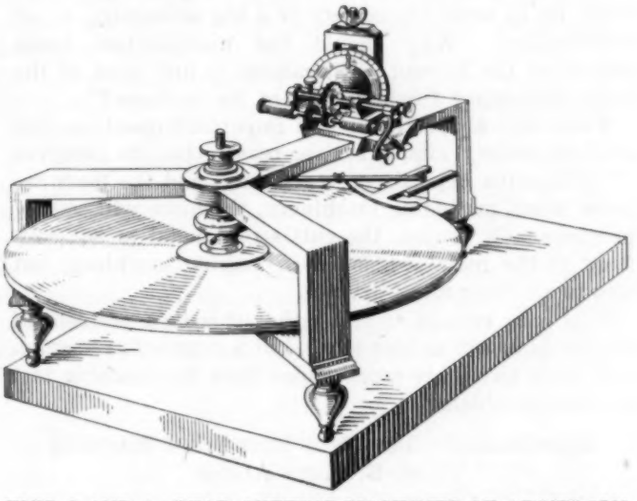


FIG. 2—TWO GERMAN CLOCK GEAR CUTTING MACHINES

This is evidence enough that milling was a known and practiced operation at least as far back as 1750. Fig. 1 is a reproduction of Plate XIV from the French encyclopedia and shows an assortment of clock makers' tools of this period. The tool *A* is the device mentioned in the latter part of the definition, while *B* is the common form of a "fraise," and is what we would call a rose countersink. It will be noted that the end of this looks not unlike a strawberry or "fraise." Attention is also called to *C* which is a hand punch for cutting gear teeth.

Leupold (1724) describes the two gear cutting machines shown in Fig. 2, these being intended for clock gears. The machine in the upper part of the plate shows a cutter with a toothed edge, and in the description the word "schneiden" is used, which certainly does not mean either to grind or to file. The figure in the





FIGS. 3 AND 4—GEAR CUTTING MACHINES OF ABOUT 1745

lower half is intended for heavier gears, and accomplishes this by a reciprocating motion of a toothed cutter. This is more of a broaching or sawing process than a milling process, but the idea of cutting with a formed tooth is close to the basic principle of milling. Figs. 3 and 4 are machines of a later period, but not later than 1745. The milling cutters are plainly shown, and the word "fendre" which means to cut is used in the title.

This evidence would tend to prove the contention of the writer that conditions were most favorable among the clock makers in France for the invention of the milling cutter. On the other hand, an early French writer on the subject of Horlogerie says that all arts and trades flourished and advanced during the reign of Louis XIV except that of clock making, for which

the English seemed to have had an established reputation. He also says that the English were very secretive about their methods so that "the Genevans who wish to learn the watchmakers trade come to France, where they can learn more in one year than in England in ten." This indicates that the process of milling may have been invented in England, possibly earlier than in France. However, all the proof we can have of this at this time would be in the form of an engraving or description. Possibly some of our English readers can supply this. One thing is certain: There is always more knowledge and practical information in men's heads than is to be found on paper, and at a time when it took Besson (1570) about ten years to find a publisher for his book, we may be sure that inventors and discoverers did not rush into print as commonly as they do now.

Are Metal Workers Hidebound?—Discussion

By E. F. DuBrul
General Manager, National Machine Tool Builders' Association

On page 154 of *American Machinist*, the editorial question is asked, "Why is it that so little research work is done on metal cutting?"

Further along in the same editorial you ask, "Are metal workers more indifferent, more stupid, more hidebound than steam engineers, electricians and builders, or what?"

You also ask, "Isn't this subject big enough to be taken up by some big society or a big university, or all universities? Why should the machine-tool trade depend on the Bureau of Standards to find some of the most elementary fundamentals of its business?"

These are all pertinent and important questions for civilized society, simply for the reason that the progress of civilization depends on machinery, and the more we know about producing machinery, the more will society progress. Of course, the cutting of metal is not confined to the metal employed in making machines, but also to all other metal articles.

It is easy enough to think that this is a problem of the machine tool builder alone, but a moment's reflection will show that it is much wider than the machine tool builder's problem.

Responsibility Does Not Rest With Machine Tool Builders Alone

The machine tool builders produce about twenty-five per cent of the total production of industrial machinery, but in addition there are tremendous quantities of electrical machinery, locomotives, railway cars, metal structures, ships, and other products made of metal that far over-shadow the value of the product of the industry that makes the machines that cut the metal. Therefore, the importance of your questions should be realized by the users of the machines, even more so than by the machine tool builders. Conceivably, the machine tool industry might subscribe to a fund sufficiently large to conduct all the research that ought to be conducted for the benefit of all its customers.

So many questions of research have already been raised that it is no exaggeration to say that under proper supervision a productive and valuable research campaign could be conducted, and as much as $200,000 a year could easily and well be spent in that sort of work for a number of years to come.

There is on file in the office of the National Machine Tool Builders' Association a list of questions that deserve attention. It is a long list of about fifty subjects, and anyone of these subjects would require from $5,000 to $10,000 a year for proper research. Unfortunately, the machine tool industry, as such, cannot assume this burden, nor can it ever get enough for its product to do so.

It seems to me that it would be very profitable for all metal working industries to join hands in financing research work of this sort. The fundamental problems are beyond the capacity of any single concern to solve within a reasonable length of time. But if an organized effort were made through the various associations of metal working manufacturers, if a research committee were appointed to supervise the work, and if the funds were forthcoming, all of the questions of your editorial could be answered, and so promptly perhaps as to be surprising in their profit to all. Many years ago I suggested, through a letter to *American Machinist*, the desirability of some sort of a national organization of machinery manufacturers to look after just exactly such movements as these research questions involve, movements that affect all machine builders.

A number of machinery organizations exist. Through a federation they could arrive at solutions of problems that touch all of them, while still retaining their own individualities and organizations that deal with the problems peculiar to each branch. The electrical industry has such a federation; the music industries, the paper industry, the automobile industry, and the lumber industry, all have such federations. The way has been pointed out to the machine industries. It only requires a very slight effort on their part to develop a similar organization.

Do Rush Orders Pay?

By A. L. De Vinne

Do rush orders pay, is a question upon which opinion is generally widely divided. However, the fact that some establishments make a specialty of filling rush orders, would make it appear as though there was considerable to be said on the affirmative side.

We see that a greater proportion of such concerns include merchants and printers rather than manufacturers. Considering the former concerns, we find that their ability usually consists principally in the knowledge of the sources and of the financial strings existing with one or more orders. They can thus lay their hands on job lots or mill runs where ready cash will insure low terms and prompt shipments. Printers take advantage of the fact that, in their line, night work is quite common, and they reduce their overhead percentage by running as nearly 24 hours a day as circumstances will permit. To make a success of this practice, there must be only a few who offer to do such work.

In general, where the larger proportion of the manufacturing costs is in material and overhead, it will readily be seen that rush orders seldom raise the invoice price of the materials, while they do save in storage costs and in interest. The increased labor cost, even where it exists, may be many times overbalanced by the saving in the overhead percentage.

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Big Shops versus Little Shops—Discussion

BY J. T. TOWLSON

With reference to the interesting contribution of R. F. Moore, on page 368, Vol. 56, of *American Machinist*, I am of the opinion that whether such a job as the drilling of holes so small as ☆ in. in diameter in precise location be done in a large shop or a small one, the most dependable method cannot be by way of using a combination center drill, nor yet by actual dependence upon the accuracy of the dividing head. It is quite possible for the head to be all right and yet to have the holes out of position when using such a small drill.

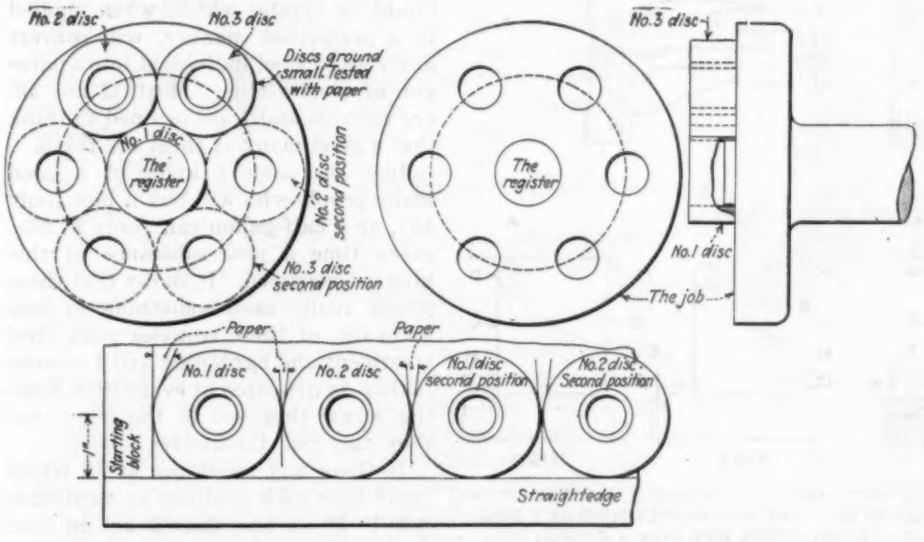
My personal preference would be for the "disk" method, which involves the use of three disks accurately ground to diameter and used as shown in the illustration. With a highly polished work surface and careful workmanship this method is hard to beat.

The first disk is attached at the center of the piece to be drilled while the second is clamped in such position as to touch the central one. This second disk thus becomes a drill bushing, or jig, through which the first hole is drilled and reamed.

The third disk is now clamped to the work in position to touch both the central and second disks, where it becomes the jig for the second hole. The second disk may now be detached and moved ahead of the third one in position to drill the third hole, thus stepping the two disks alternately around the central one until the circle is completed.

In my own practice I prefer to have the disks ground to a slightly less diameter than that necessary to secure the calculated distance between centers of the holes and then use paper of the proper thickness for locating them, as in this way one may be sure that the several locations are right by adjusting the positions of the disks so that the paper will pull from between them.

[Our contributor's method is an excellent one, but involves the fatal disqualification of requiring about forty dollars' worth of special tools to do a five dollar job.—Editor.]



THE DISK METHOD OF LOCATING HOLES ACCURATELY

Buying Machines for Occasional Use

BY A. W. FORBES

To a person in my line of work it seems strange that any manager should try to have all the machines in operation at once, a policy that is criticized by John R. Godfrey on page 833, Vol. 56, of *American Machinist*. As the bulk of our machines go to shops where they are not used more than one hour a day, such a course seems to be the only natural one.

When a man buys a micrometer, he never expects to use it for a very large part of the day. When he buys a tool grinder he only has to find a saving of about 2 min. a day to make it a profitable investment. A small engine lathe will require a saving of perhaps 15 min. a day of one man's time, and sometimes 2 min. of work will save 15 min. waiting. Yet it is hard to find the manager who would consider installing a lathe for 2 min. work a day.

On going through a certain shop I saw a drilling machine that looked as though it was idle most of the time. The manager commented that this drill was a very profitable investment. There was one size of hole that a number of men had to drill occasionally, but the nature of the work did not permit its being routed so that the pieces could all be drilled in one lot. There was an average of about six holes a day drilled of this size, requiring a total time of 100 sec. per day, and with the drill in place this was about the total elapsed time. Without this drilling machine the man would have to walk across the room; find out when one of the other machines would be free, and take his work over to it at that time, a loss of perhaps 5 min. on each hole or a total loss of 30 min. a day.

Some managers seem very slow to take advantage of such economies, but looking at my own shop, I find that I am in the same class. I could use another lathe, another drilling machine and possibly some other tools to advantage. I intend to buy them, but *when* is the question.

Gage for Indicating Rake Angles in Hob and Cutter Teeth

By Harry E. Harris

The gage herein described was designed by the writer for his own use; it will indicate the face angle of fluted cutting tools as large as 8 in. in diameter and 10 in. in length. Whether the flutes are straight or helical makes no difference. Its range is from a negative rake of 5 deg. to a positive rake of 30 degrees.

Referring to Figs. 1 to 3, *A* is a knife-edge straightedge sliding in protractor member *B* which has angular adjustment in the base *C*, the latter being graduated in degrees. *D* is a clamping stud for holding the protractor at any angle to which it may be set.

The block *E* slides in the groove *F* in the base *G* and carries the rod *H* on which the protractor is slidable in a direction at a right-angle to the groove *F*. This arrangement maintains the protractor at a right-angle to the axis of the tool to be indicated, in whatever location the protractor may be moved.

The tool to be indicated is supported by the centers *J* which are adjustable axially with the tool.

The center of angular adjustment *M* of the protractor is always in the same horizontal plane as the center line of the centers *J*, and therefore in the axial plane of the tool to be indicated.

By bringing this protractor against the back of the tool to be indicated, and rotating the tool until the extreme cutting edge is coincident with the protractor's center of angular adjustment *M*, the rake angle can be accurately found by means of the straightedge *A* and the graduated sector. The angle thus found is always the rake angle as measured from a radial line at the tooth intersection. As *A* is a knife edge and always makes a line contact with the tooth face, neither angular gashes nor helical flutes affect the accuracy of the angle as read on the sector.

In grinding the tooth faces of fluted tools, abrasive wheels wear so rapidly that the resulting angles do not always agree with the setting of the grinding machine, and as any variation from a predetermined angle on a hob or formed cutter will result in inaccurate work, it is necessary to check the angle of toothface after grinding and before putting the tool to work.

With a little experience in indicating angles of toothface after grinding, and comparing the angles with the setting of the grinding machine, the grinding machine operator will soon be able to set his machine so as to make allowance for any change due to wheel wear.

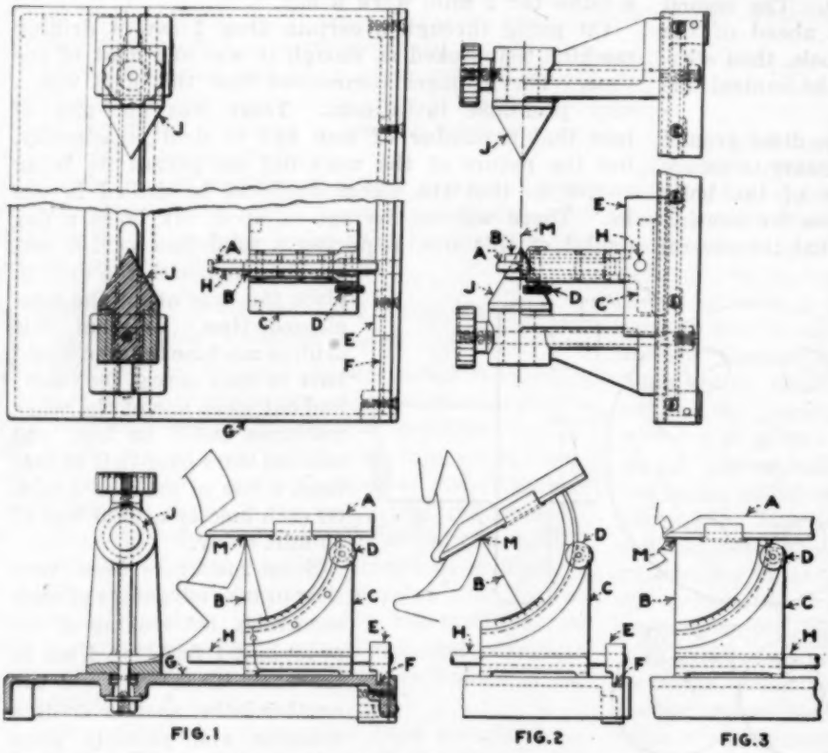


FIG. 1 FIG. 2 FIG. 3

FIG. 1—GAGE WITH PROTRACTOR SET FOR INDICATING A RADIAL TOOTH FACE ON A TOOL 8 IN. IN DIAMETER. FIG. 2—PROTRACTOR SET FOR A HOOKED TOOTH. FIG. 3—PROTRACTOR SET FOR A SMALL TOOL WITH RADIAL TOOTH FACE

Can These Things Be True?

By M. Tolliver

I received the other day a little folder from the A. B. C. Company, which by the way is not the right name. This folder describes the wonderful qualities of a substance the company recommends for heat-treating and hardening of steel. It is a powder; it is poisonous and must be kept dry, like the rest of the United States.

The claims made for this substance are the following: It replaces carbon in burned steel; it makes a tool hard and tough; it eliminates brittleness; it increases tensile strength; it is steel's affinity; and, last but not least, it is the only compound known that will eliminate brittlenesss in stellite.

Forgetting for the present the romantic side of this compound, namely that it is steel's affinity, there is enough left to make a person wonder that the world has gotten along for so many years without this substance. I was particularly interested in the fact that it will eliminate brittleness in stellite. As stellite is not a steel, as, in fact, it has no iron contents at all, and as it is not hardened, I wonder how the powder is used and how it acts.

This little pamphlet is not the only one I have received. Every so often somebody comes out with a powder, or liquid, or crystal which, when applied in a prescribed manner, will convert any wicked steel individual into a paragon of steel virtue. Most, if not all, are failures and I am inclined to think that a good many of them are fakes.

Just the same I know of a good many people who will buy a box (only $5), or a half-gallon can (only $7.86), every time a new substance of this kind is advertised. It shows that these people really need something to help them out of their troubles with steel treatment and hardening and I wonder if they do not catch at every little floating straw they see in the hope that they may pull themselves up.

Is there any substance at all which could have such qualities as mentioned here? If so, how does it act on steel and why does it have these results?

Couldn't you give us small fellows some information on this subject or maybe draw out some of the bigger men who have had a chance to do experimenting and really study the matter from top to bottom in plants where facilities were available to investigate the problems more thoroughly than can be done in small shops?

If things like this substance are mere fakes, exposing them would do a great service to a number of people. It is not so much the $5 that is spent, but that every time they try a thing like this, they fool themselves and get just that much further away from real knowledge and the final solution of their problems.

Blueprinting from Typewritten Sheets

By H. Broome
Derby, England

Many of your readers may overlook the importance of the kink mentioned by Frank Harazim who, on page 420, Vol. 56, of *American Machinist*, refers to a method of obtaining blueprints direct from typewritten matter, but fails to point out that a special typewriter ribbon has now been placed on the market that gives even better results.

A resumé of the application of the principle may serve to emphasize the point and will undoubtedly be of service to production engineers in search of a simple and direct method of supplying information to the man on the job.

The writer is in charge of the operation section of a large factory organized for repetition work, and a year ago was faced with the problem of instructions for the production of small quantities of components to fine limits without interference with the ordinary shop organization.

Having decided on the typewriter as the quickest method of producing the master list of operations, we stumbled by accident on the method advocated by your correspondent—of securing a clearer blueprint by typing with a reversed carbon sheet at the back of the master list. At the same time we sent out inquiries as to the possibility of obtaining a specially prepared ribbon for the purpose, and ultimately we secured the very efficient "Barco" special blueprint ribbon which gives the required effect and is supplied by the Bar Lock Typewriter Co., Ltd., of London.

It may be of interest to state that by careful experiment we found that, using ordinary detail paper or thin bond paper as used for ordinary typewritten correspondence, we were able to secure a readable blueprints as given below in order of visibility:

1. "Barco" ribbon.
2. Ordinary carbon copy with reversed carbon paper at back.
3. Ordinary purple ribbon with reversed carbon paper at back.
4. Ordinary carbon copy without reversed carbon paper.
5. The ordinary commercial purple typewriter ribbon used alone is practically useless.

It will be obvious that if the paper is unsuitable or an exceptionally good copy is required the special ribbon may be supplemented by the reversed carbon paper, and also that pencil sketches are rendered more effective if a reversed carbon paper is used underneath, which in itself is a useful kink for the man who is making sketches that must show clearly.

A Self-Acting Drift

By Robert Brainerd

One of the boys in our shop, whose regular job is running a heavy drilling and boring machine, became tired of trying to keep track of his hammer and drift and so invented the tool shown in Fig. 1.

The handle is bored to a sliding fit for the shank

FIG. 1—A SELF-ACTING DRIFT

of the drift, the hole extending down nearly to the heavy part as shown in the sketch, Fig. 2. A slot is milled in the side of the shank and a screw put into the handle with the inner end projecting into the slot so that the drift cannot slip out of the handle. The

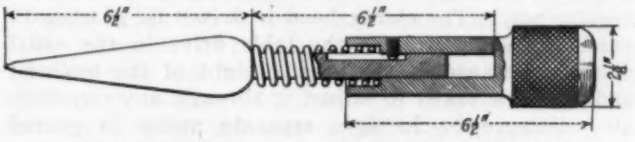


FIG. 2—DETAILS AND DIMENSIONS OF DRIFT

end of the handle is counterbored to receive the spring.

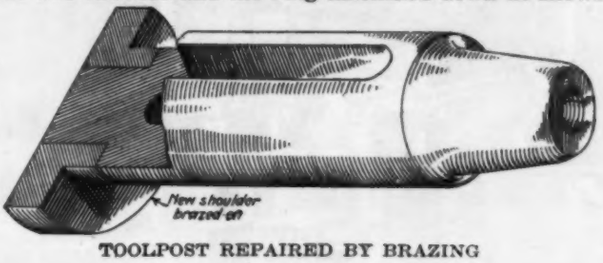
When the operator wishes to remove a drill or other tool from the machine spindle, he inserts the point of the drift into the slot in the spindle and slams the handle against the drift-shank. This can be easily and quickly done with one hand, and works beautifully.

A Toolpost Repair

By George Wilson

The toolpost belonged to a new lathe. For some reason the builder had considered that a shoulder ⅛ in. thick was sufficient to sustain the screw pull, and of course it had to pull off just when the machine was most urgently needed.

A quick repair was made by turning down the shoulder end and brazing on a ring. After brazing, the post was chucked and the ring machined down as shown



TOOLPOST REPAIRED BY BRAZING

in the sketch. Cyanide was sprinkled on at the same time the brazing was done, and the piece was case-hardened; care being taken to keep the cyanide off the part that had to be machined.

The ring was given a long bearing on the post to increase the area for brazing so the ring would not pull off. The width of shoulder was increased to ¼ inch.

Special Planer for Heavy Work

By HERBERT CRAWFORD

The Ajax Manufacturing Co., Cleveland, Ohio, builds forging machinery which runs into large sizes, some of the beds weighing 60 tons and measuring 9 ft. 8 in. in length. The handling of this work in the shop is a difficult proposition and the planing becomes a real problem. To plane these beds in the ordinary manner would require a planer of extraordinary size and power. So the Ajax company has built a special type of planer for machining the beds as shown in Fig. 1. While the moving tool might put this machine in the shaper class, the traveling ram and the crossrail for the toolhead travel, seems to bring it back into line with the planer.

The machine consists of the two rails or ways, *A* and *B*, which carry the traveling ram with its toolhead *C*. The rails are mounted on substantial columns *D* and *E* and tied together by the housing shown at *F*, in both Figs. 1 and 2. Beneath the machine is a massive bedplate provided with T-slots running in both direction as can be seen.

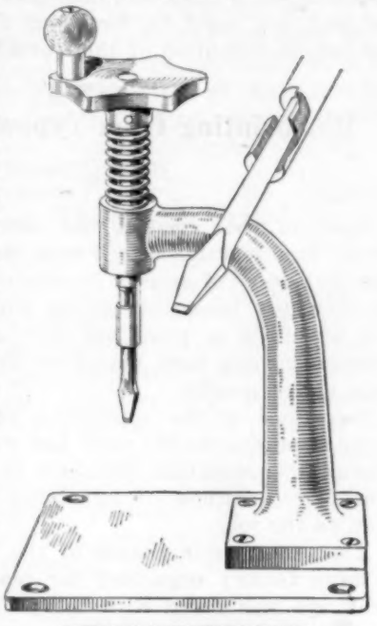
The piece to be planed is located beneath the planer head, blocked up to suit and is then planed in the regular way. The planer head is driven by gearing in much the same way as the table drive in the usual planer. Because of the great weight of the toolhead and the time taken to adjust it through any considerable distance by hand, a separate motor is geared directly to the operating screws. The original drive was from a countershaft located in the gallery as at *G*, Fig. 2, and there were controls on each side as at *H* and *I*, which could be operated from any point along the ways. Since the photographs were taken the drive has been changed. A 35-hp. direct-connected reversing motor is now used and we find the point of reverse more positive and the efficiency increased because of the greater power delivered. It will be noted that the ram travels in V-grooves and also has an upper guide on each side to prevent its lifting off the Vs.

Bench Screwdriver for Rapid Assembling

By T. COVEY

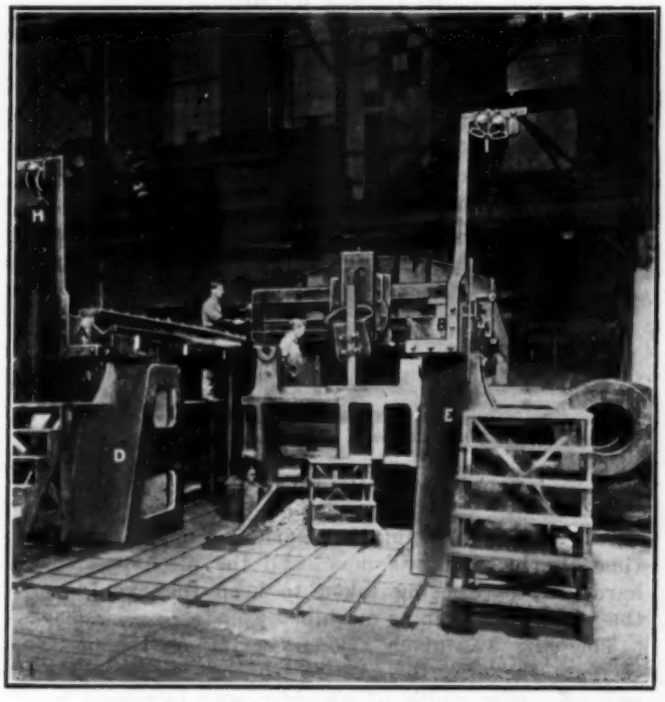
The accompanying illustration shows an efficient and cheaply constructed screwdriver to be used in assembling parts that require a large number of small screws.

To a suitable base plate is secured a bracket in the overhanging end of which is a bearing to hold a spindle in a vertical position, and to the lower end of the spindle the screwdriver is attached. At the upper end is keyed a star-shaped knob, or wheel, that enables the operator to secure a firm hand grip when tightening the screws or loosening obstinate ones. A wooden handle, held to one of the projections of the star by a shouldered screw, provides means for rapid and easy rotation of the screwdriver.



BENCH SCREWDRIVER FOR PRODUCTION

The base plate may be secured to the work bench by means of wood screws. A light coil spring below the star balances the weight of the spindle and its attached parts, holding the screwdriver above the work. The strength of this spring should be so calculated that the weight of the operator's hand is sufficient to overcome the tension and bring the blade down to the screw slot.



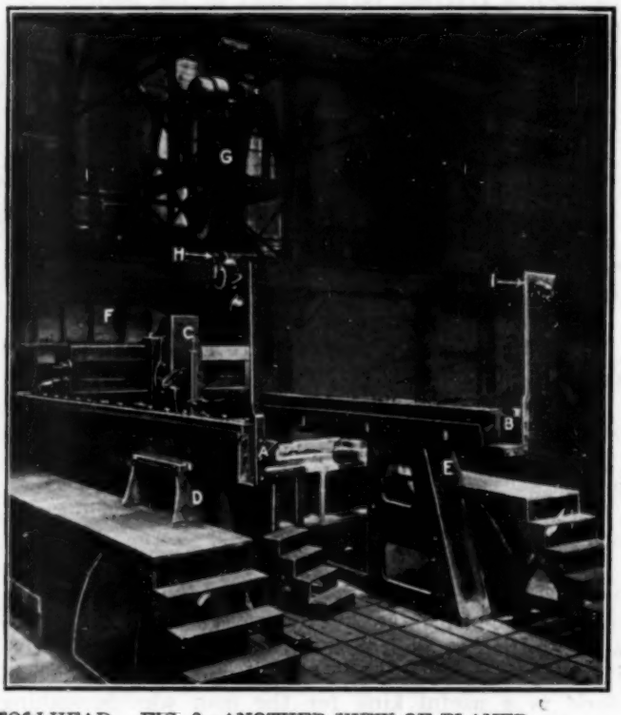


FIG. 1—SPECIAL HEAVY PLANER WITH TRAVELING TOOLHEAD. FIG. 2—ANOTHER VIEW OF PLANER SHOWING DRIVE ABOVE

Making a Large Gear Wheel Under Difficulties

BY K. SALDIS

Reading in a recent issue of *American Machinist* of the making of a flywheel under difficulties, I am reminded of a job that once fell to me that taxed my ingenuity to a considerable extent before I could figure out a way to do it.

Quite a while ago we received an order for a job that was about seven sizes too big for our equipment, but, as there were no machines larger than ours within a distance of several hundred miles, it was up to us to get out the work. The order was for a gear wheel, 8 ft. (more or less) in diameter, 6-in. face and 4-in. bore. The wheel that was to be replaced was made of wood and was quite apt to change its size and shape without due notice in accordance with the weather conditions, and had caused such an endless amount of trouble that the owners had decided they must have something that could reasonably be expected to remain true and of one size for quite a while.

USING THE EQUIPMENT AT HAND

Our largest machine for turning was a vertical boring mill of 48-in. swing and therefore all of our work had to be done with improvised tools. Fortunately, the new gear was to have wooden teeth set into pockets or slots in the rim, which was to be about 1 in. thick.

The first thing to do was to make a heavy bushing of steel, which we bored in a lathe to 3⅛ in. internal diameter, or ⅛ in. less than the finished bore of the gear. This was used as a hub core, being set in the mold and the iron poured around it. Regular cores for the rim slots were also set in the mold but were not allowed to project clear through the rim section. These cores were set from the inside of the rim so that when the casting was poured the periphery presented a smooth unbroken surface; otherwise we could not have turned it in the way we did.

When the casting was ready to work upon it was leveled up on a floor plate and a yoke built up over the hub with blocks, bolts and straps so that a large pointed setscrew tapped into the horizontal bar that formed the upper member of the yoke would stand parallel to and directly in line with the axis of the casting.

You will remember that the actual hub of the casting was formed by the bushing of steel that had been cast in, so that we now had to remove only the remaining 1/32 in. of metal all around the bore. A 4-in. reamer was set in place under the setscrew and by means of long wrenches, much muscular exertion and a great many expressive remarks, we were able to turn it through the bore, feeding by means of the setscrew and leaving a smooth true hole that was of the correct diameter and surprisingly near to the center line of the casting.

To turn off the periphery of the wheel we dug a pit out of doors around which we placed a framework of 12x12-in. timbers and to the side members of this framework we bolted improvised wooden bearings. An arbor was driven into the bore of the wheel in which a keyway had been cut by the hammer and chisel process, and the job was jacked up in position while we poured the babbitt. The arbor extended through one bearing far enough to permit a pulley or band wheel, almost as large as the casting, to be keyed on.

The line shaft was extended through the wall and a small pulley placed upon it in alignment with the big one on the arbor. A suitable belt was then placed around the pulleys and we were ready to proceed with the turning.

HOLDING THE TOOL

There was considerable discussion at this point as to the best way to hold and manipulate the turning tool. One suggestion was to place a small lathe across the pit facing the wheel and block out the carriage sufficiently to get the tool in the place where it would do some good, but this idea involved so much extra rigging that it was abandoned in favor of turning with a hand tool. This was the way the turning was finally accomplished and was one of the very few occasions in my life when I used a "hook" tool. I do not care to repeat the experience.

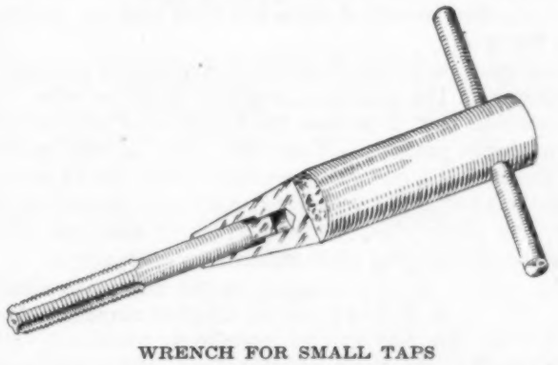
However, we managed to produce a fairly round and true rim. The thin walls left by the cores at the bottom of the tooth pockets were then knocked out by means of hammer and chisel and the slots finished through, ready for the reception of the wooden "cogs."

We secured by this method an iron gear wheel (though with wooden teeth) that ran fairly true, considering the way in which we were obliged to make it, and that was far superior to the all-wood gear that it replaced. I would not, however, advise any readers of *American Machinist* to make gears in this way as a regular practice if modern boring mills or turning lathes of suitable size are available.

A Small Tap Wrench

BY CHARLES KAUFMANN

To the toolmaker who has many small holes to be tapped in the course of his day's work, the wrench shown in the sketch will prove a valuable aid. It is made of a piece of brass rod of suitable diameter, tapered toward one end by filing in the speed lathe and drilled with a hole to fit tightly over the shank of the tap. The



WRENCH FOR SMALL TAPS

hole is then drilled further with a drill of a diameter equal to the width across the flats of the squared end of the tap. No broaching is necessary. Hold the tap in the vise and drive the piece of rod over it. The harder metal of which the tap is made will cut its way into the smaller hole and hold the tap against any twisting strain that the tap itself will stand. The wrench is not supposed to be taken off while the tap lasts, but to become a part of and stay with it when it goes in the crib or toolkit.

Editorial

The Brooklyn Bridge

ONE of the four cables of the Brooklyn Bridge slipped lengthwise 1¾ in. That is to say that the total effect of uneven loading over a period of forty years was a shift of 1¾ in. in more than 4,000 ft. To some people this means that the bridge is faulty, unsafe and should be rebuilt. To others it means increased respect and admiration for the men and the profession who can build a structure which, after forty years of continued service and overload is still so fit that an almost negligible shift startles the world out of its dream that anything can be made by human hands which will last forever. Surely if this job did not reach perfection, it came near it.

Standardization for the User of Machine Tools

THERE are two distinct phases to the subject of standardization of machine tools—the advantages to the manufacturer in decreased costs and the advantage to the user in the ability to interchange tools and fixtures from one make of machine to another. The first phase has received considerable attention to the extent of making parts interchangeable on given makes of machines.

There has also been some standardization of machine capacities, notably in milling machines, and planers are also falling in line. But the customer's point of view, the ability to interchange tools and fixtures, has been almost entirely overlooked. It is necessary in many cases to make separate tools and fixtures for each machine, in others the use of adapters of one kind or another is the usual solution. The first means much unnecessary expense, the second is rarely entirely satisfactory, even though it costs less than making new tools and fixtures.

The mention of standardization frequently arouses resentment in the minds of machine builders who seem to imagine that it means the building of all machines to a single pattern. They fear that it will prevent the development of new ideas, that it will not be possible to make their lathe or boring machine different or better than their competitors and some even go to the extreme of deriding all standards.

An answer to this is found in the automotive industry. The S. A. E. has probably adopted more standards, which are in use by its members, than any other organization, yet we know that few of the best known automobiles are alike in details. Using standard bolts and nuts, standard connections for brake rods, standard sizes of wheels and rims, do not make all cars alike. The designer simply picks standard units and works them into his own ideas of a completed motor or chassis.

In order to still further allay the fears of machine builders let it be understood that rational standardization will not affect the dimensions of their bearings, of their feed screws, of their ways or back gears. It only aims to standardize such parts as affect the user of the machine—namely the work-holding and tool-holding portions of the machines.

It is quite possible that the day may come when machine builders will themselves determine the best size bearing for certain duties. They would then select such a size for any new machine as a matter of economy. The present movement however is confined entirely to the user's side of the question, and, so long as a machine does its work and stands up, the user should have no complaint if the bearings do not accord with his previous notions on the subject.

The Need of Data for the Diemaker

THE manufacture of stamped articles has taken enormous proportions. Many shops contain hundreds of power presses and use thousands of dies, many of complicated construction. One would naturally think that an industry of such importance rests on well-known facts and data, and yet the reverse is true.

Almost every time a new piece must be tooled, the diemaker is confronted with a completely new riddle, and his only way of solving the problem is experimentation. A skillful diemaker, a man with much experience, may sometimes get along without much experimenting but he never feels quite sure of the results until the piece is actually produced.

He will start with the finished piece, making one by hand, the best way he can. Working his way back, he develops the various shapes it must pass through and the operations and dies required to bring it from one step to another. Each of these steps is again a subject for experimentation and quite often each one requires a new hand-made model. He may find that the metal will not stand the deformation caused by changing one shape into another and he may have to add operations or, maybe, start all over again. Even when he has solved the problem of how to make the piece, he remains uncertain whether another way would not have been better or simpler. Neither does he know what size press is required for each of the operations. He may know the amount of room but not the amount of pressure needed for forming, drawing or swaging.

He is, in short, absolutely without data. There is no established authority to tell him what to do, and to assure him that he will get the desired results when he does it. Maybe there are data here and there, collected by some progressive concern, but they are private property and will probably be safeguarded as such.

It would seem that a thorough study of this subject would be in order and that colleges, universities and other scientific institutions could make themselves an additional power for good by an investigation of this subject. At the same time, such an investigation by disinterested parties would not relieve the manufacturers of dies and die-produced articles from the responsibility of investing some of their profits in research work. They would get their investment back many times over.

Shop Equipment News

"Elecdrive" Screw and Nut Setting Tools

The electric tools illustrated herewith are the product of the Elecdrive Manufacturing Co., Inc., Syracuse, N. Y., and are for use in driving and setting screws, studs and nuts. Two types of the tools are made, portable and stationary.

The portable tool, Fig. 1, resembles an electric drill in general outline and can be operated from an electric light socket on either direct or alternating current of 110 volts, providing the alternating current has a frequency of not more than 60 cycles.

The stationary tool, Fig. 2, should be operated from a power line, though if the light wiring has a large enough safety factor the tool may be operated from a light socket. The motor of the stationary tool is universal under the same current conditions that govern the motor in the portable tool. The motors in both tools are of the high-speed type and operate the spindles through gearing having a 10 to 1 reduction.

The driving mechanism consists of a multiple-disk clutch, adjustable for any torque within the capacity of the motor, and driving a positive clutch through a splined shaft. The positive clutch automatically "kicks out" when the disk clutch is fully released, at which time the driving spindle is entirely free. This feature permits the removal and replacement of tools while the motor is running at full speed. It is claimed that the slip clutch insures all screws and nuts being driven to the same tension and that it prevents shocks to the motor. The clutch is so constructed that it cannot be overtightened and thus the tool cannot be overloaded.

A special feature is the provision for slow setting up of screws and nuts. During the period the screw or nut is being driven the spindle runs at 1,000 r.p.m., but during the actual setting it is slowed down to about 350 r.p.m. The tools are furnished with recessed and tapered wrenches so that nuts can be picked up while the spindle is running at full speed. Nuts and screws

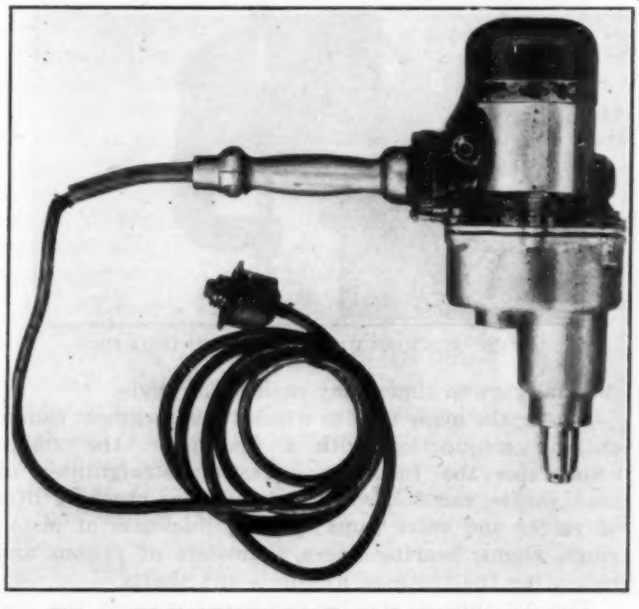


FIG. 1—"ELECDRIVE" PORTABLE SCREW AND NUT SETTING TOOL

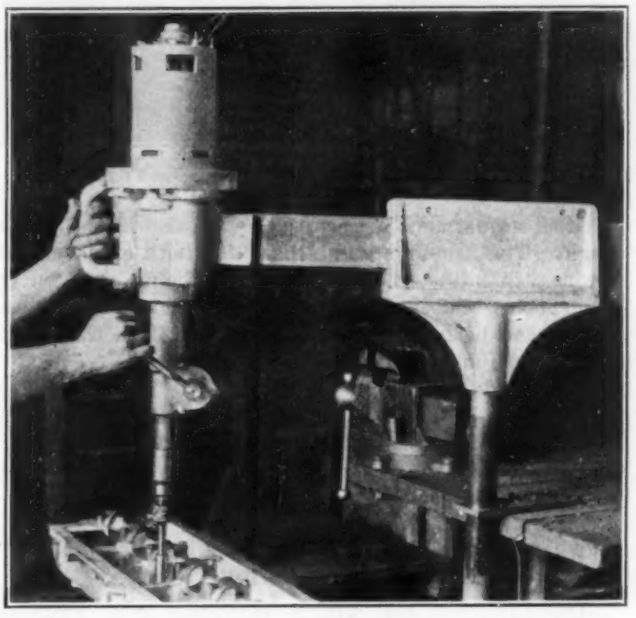


FIG. 2—"ELECDRIVE" STATIONARY SCREW AND NUT SETTING TOOL

are held in the wrenches with their axes in line with the spindle so that threads can be engaged without danger of crossing.

The stationary machine can be equipped with a hopper for handling screws and double-chamfered nuts. Both tools will take Jacobs chucks and can be used as electric drills.

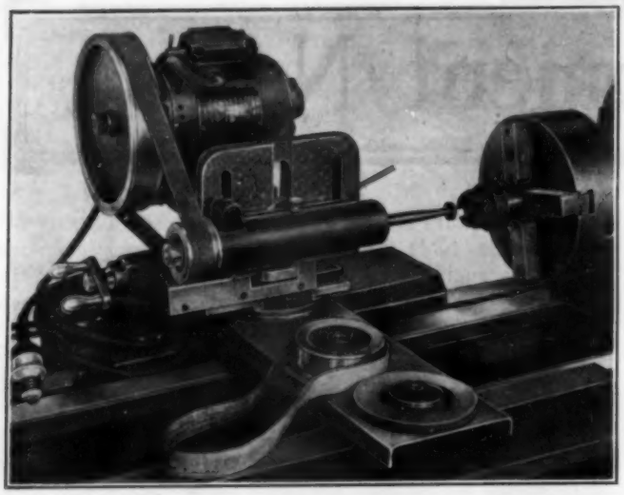
The portable tools are made in two sizes, weighing 11 and 13 lb., and will drive and set nuts from ¼ to $\frac{7}{16}$ in. and from ⅜ to ½ in. respectively. The stationary tool handles nuts from ½ to 1 inch.

U. S. Electrical Tool Co. Combination External and Internal Grinding Attachment

The grinding attachment illustrated herewith has lately been brought out by the United States Electrical Tool Co., Cincinnati, Ohio, and can be used on lathes as small as 10-in. swing.

The angle plate, on which the attachment is mounted, is secured to the toolblock of the lathe, the motor and spindle being on opposite sides of the vertical member.

The motor is of the universal type and can be operated with either direct or alternating current, where the latter has a frequency of 60 cycles or less. The motor is pivoted to the angle plate, permitting movement for tightening the belt. The spindle has a



U. S. ELECTRICAL TOOL CO., GRINDING ATTACHMENT

vertical adjustment of 4 in. and can also be set at an angle. The same spindle is used for both external and internal grinding, the relative speeds being changed by transposing the pulleys. Different lengths of wheel arbors can be inserted in the spindle. Both the motor and spindle are fitted with ball bearings.

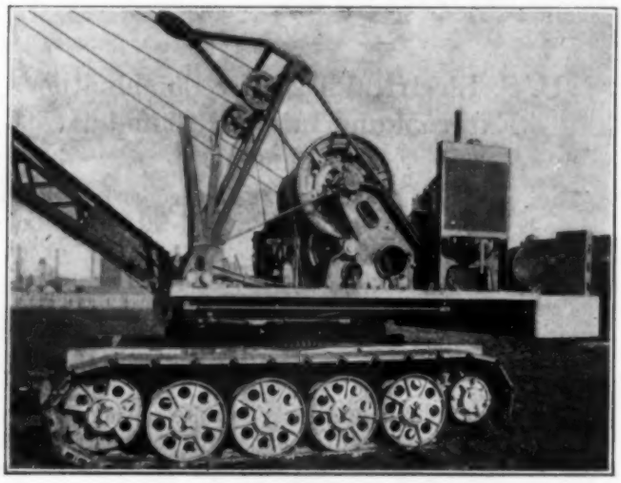
The regular equipment includes: Three pulleys, giving spindle speeds of 30,000, 16,500, 9,500 and 5,500 r.p.m.; two grinding wheels, one 6x$\frac{3}{4}$x$\frac{1}{2}$ in. for external work, and one 1x$\frac{1}{4}$x$\frac{1}{2}$ in. for internal work; one wheel arbor 3 in. long, and two woven belts.

Link-Belt Crawler Crane

The Link-Belt Co., 910 S. Michigan Ave., Chicago, Ill., has added to its line the crawler crane illustrated.

The crane is operated by a heavy-duty, 4-cylinder traction engine running at 800 r.p.m. and equipped with an automatic governor, gear-driven fan, centrifugal pump, high tension magneto with impulse starter, and force feed lubrication to all bearings.

The boom is 35 ft. long and is of angle and lattice bar construction. The hoisting cable is $\frac{3}{8}$ in. in diameter. The boom-hoisting mechanism is automatically self locking. The rear axle construction is similar to that used in automobile practice, and is equipped with cut bevel gears running in a bath of oil.



LINK-BELT CRAWLER CRANE

There are only sixteen gears in the whole machine and, with the exception of the slow moving rotating gear and pinion, all are cut from solid blanks of steel or bronze.

The clutches for swinging, traveling and hoisting the boom are of the expanding type and require very little effort to operate. The clutches for the hoisting and holding drums are of the same construction and the brake drums are so constructed as to enable the operator to set the brakes either before or while hoisting the load so that the moment the hoist clutch is disengaged, the load will be instantly and automatically held in position.

All bearings are fitted with easily renewable bronze bushings and the principal bearings are all of the same size. All bearings are lubricated with grease under high pressure.

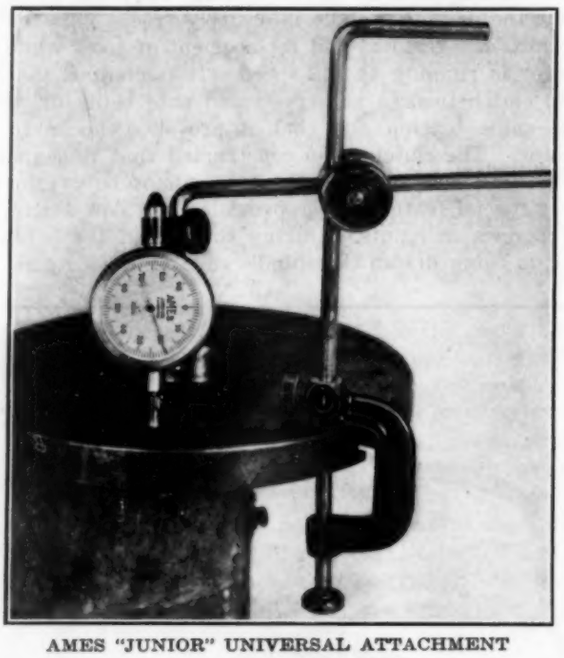
The complete crane is only 11 ft. 8 in. high and can be loaded, completely assembled, on a standard flat car. It can be loaded or unloaded by its own power by providing an incline from the ground to the car.

A 40-hp. electric motor for any standard current can be supplied to operate the crane in place of the gasoline engine, if desired.

Ames "Junior" Universal Attachment

The B. C. Ames Co., Waltham, Mass., has recently brought out the attachment shown in the accompanying illustration for use with its junior dial gage.

The attachment can be applied to any object within the range of the clamp and can be so set at to bring



AMES "JUNIOR" UNIVERSAL ATTACHMENT

the dial gage to almost any position or angle.

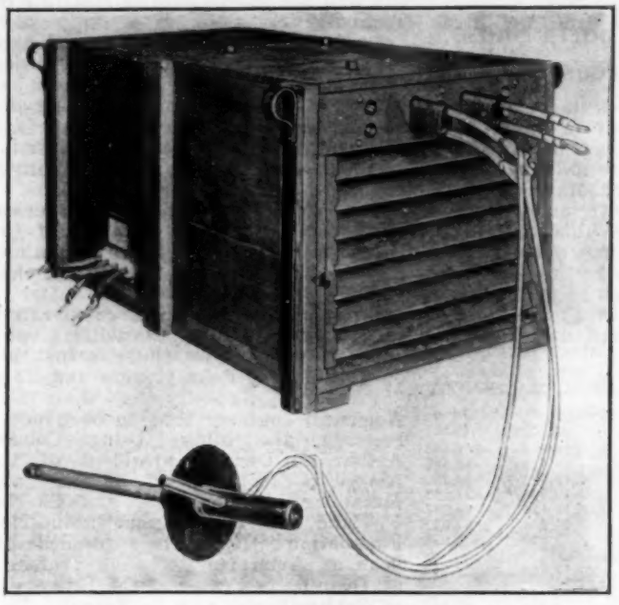
Among the many uses to which the attachment can be put, in conjunction with a dial gage, the maker enumerates the following: Testing straightness of crankshafts, camshafts and valve stems; checking lifts of valves and valve cams; gaging thickness of piston rings, shims, bearing liners, diameters of pistons and indicating the truth of flywheels and shafts.

The attachment can be purchased without the dial gage if desired.

Electric Arc Transformer Rivet Cutter

On page 545, Vol. 49, of *American Machinist* there appeared a description of an arc-welding transformer operated by alternating current. An apparatus of similar type having characteristics that adopt it to cutting, has recently been brought out by the same manufacturer, the Electric Arc Cutting and Welding Co., 152 Jelliff Ave., Newark, N. J. The machine is adapted primarily to rivet cutting, although it can be used also for cutting cast iron, brass or bronze, besides steel.

The machine is made in three sizes. The Type CW, 300-amp. machine is intended for both welding and cutting, the 600-amp. machine for rivet cutting and carbon arc welding, and the 1,000-amp. for cutting alone.



ELECTRIC-ARC RIVET CUTTING TRANSFORMER

The primary magnet wire has micanite between the layers, while double micanite and asbestos spacers are placed between the primary and the secondary winding. There are large air ducts between the iron and the copper and between the layers of the copper. A bucket type of ball bearing blower is arranged to drive air through these spaces continuously whenever power is being used in the transformer.

In order to reduce the power required to magnetize the core, an automatic cut-off arrangement is provided. A magnetically operated switch is provided in the primary, so that the circuit remains open at all times when the electrode is not in contact with the work, or when the arc is not being drawn. A small pilot transformer of 100 watts capacity is employed, making the operation automatic and positive.

The electrical characteristics of the machine are different than for the welding machine in that the voltage across the arc is higher, and the drooping characteristics desirable in arc welding are not so pronounced. In operation, the kva. in the primary can be held constant and the voltage can be kept up to the value desired as the current is increased. The use of the transformer enables working with larger amperages than is possible with direct-current machinery.

Atlas 5-Ton Elevating Platform Truck

The electric elevating platform truck shown in the accompanying illustration has recently been placed on the market by the Atlas Car and Manufacturing Co., Cleveland, Ohio. Its especial use is handling large core racks into and out of core ovens. The truck has a rated capacity of 5 tons, and the platform can be elevated 4 in. in 10 seconds.

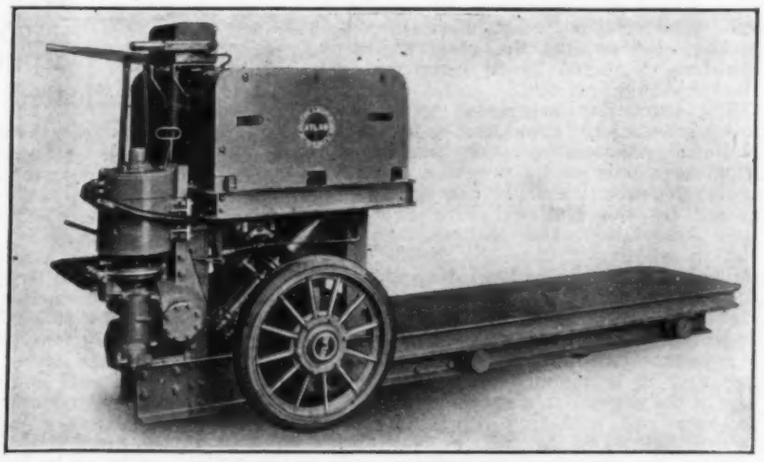
The truck may be operated by either Edison or lead batteries, the latter being standard equipment. The battery compartment is provided with removable end plates and with rails for guiding and holding the storage battery trays.

The elevating mechanism consists chiefly of a motor flexibly coupled to a double worm reduction. Four crankshafts placed crosswise of the truck, two at each end, are connected by means of bevel gears to the worms. Hardened steel rollers on the crankpins bear against hardened steel wearing plates on the under side of the platform. The crankshafts are caused to revolve simultaneously one-half revolution when it is desired to raise the platform. A limit switch is operated automatically at each end of the travel of the platform, so that the motor is stopped and the platform is held in position.

Reduction in the driving mechanism is obtained by means of an inclosed worm and wheel, the motor being flexibly coupled to the worm. A contracting-type shoe brake is interlocked with the pedal and controller safety switch, so that the brake is applied whenever pressure is completely relieved from the pedal. Three speeds are provided in each direction. A signal horn is operated by a push button on the controller handle.

The steel driving wheels are provided with rubber tires 27¾ in. in diameter and 4¼ in. wide. Their maximum speed of rotation gives the truck a speed of 700 ft. per minute, or 8 miles per hour when unloaded. The trailing or load-carrying wheels are of steel 10¾ in. in diameter and 4¾ in. face, the tread being 11½ in. They are mounted on double-row ball bearings, and a ball thrust bearing is provided to give ease of steering. Steering is applied to all four wheels.

The load platform is 7 ft. 2½ in. long and 30 in. wide, and 11½ in. from the floor in the lowest position. The machine has an overall length of 11 ft. 8 in. and a width of 4 ft. The inside turning radius is 5 ft. 9 in. and the outside 12 ft. The machine can be operated through intersecting aisles 8 ft. wide, while carrying a core rack 5 ft. 1 in. wide and 7 ft. long.



ATLAS 5-TON ELEVATING PLATFORM TRUCK

News Section

Industrial Engineers Annual Convention

Representatives from progressive manufacturing companies in all sections of the country will meet at the Hotel McAlpin, New York, October 18-20, to attend the three-day National Convention of the Society of Industrial Engineers, it is announced by the American Engineering Council. Prof. Joseph W. Roe, president of the society, and head of the department of industrial engineering at New York University, will preside.

"Economics of Industry" will be the theme discussed by speakers of national reputation. Sectional meetings for Managing Executives, Production Managers, Sales Managers, Industrial Relations Directors, Accountants, and Educators are included in the program.

The international committee for the Elimination of Unnecessary Fatigue will hold an open meeting.

A special feature will be an exhibition of factory and office equipment and appliances designed to save labor and reduce fatigue. The exhibition will be held in the commodious Winter Garden adjoining the ball room in which the principal meetings will be held.

All the meetings will be open to the public. On the evening before the convention, there will be a joint meeting of this society with the Taylor Society and the American Society of Mechanical Engineers.

The official program will be ready for distribution early in September. Copies may be obtained from the S. I. E. offices, 327 S. La Salle St., Chicago.

National Fire Prevention Exposition

Manufacturers of fire-resistive materials and of fire-fighting and retarding apparatus, for the first time, will have the opportunity of taking part in a Fire Prevention Exposition to be held October 2 to 7, 1922, at the twenty-second regiment armory, New York City, where will be shown, by exhibit and demonstration, what a vital part in the fight against the great annual fire loss is played by fire-safe materials and apparatus.

The exposition originated with the fire prevention committee of the National Association of Insurance Agents as part of its program of fire prevention activities. It has been endorsed by the National Fire Protection Association, the National Association of Credit Men, by Frank G. Reynolds, president, of the International Association of Fire Engineers, the National Board of Fire Underwriters and other associations.

A lecture hall is in the armory building and it is planned to make each day of the exposition a special day, with lectures and motion pictures in the lecture hall. One day will probably be devoted to municipal authorities and fire department officials, with addresses on municipal fire prevention and protection.

Already requests for space are reaching the exposition committee and it is expected that every foot of available space will be taken within a few weeks. A. E. MacKinnon, 405 Lexington Ave., New York City, is chairman of the exposition committee.

Machinery Exports Show Big Increase

Exports of metal-working machinery took a decided upturn in June. The total value of these exports was $1,446,866, or over a half million dollars greater than those of May, the total exports for that month amounting to $892,078. The total almost equalled that of the exports in June, 1921, in which month machinery to the total value of $1,488,213 was shipped abroad. The detailed figures, which are those of the Bureau of Foreign and Domestic Commerce, follow:

EXPORTS METAL-WORKING MACHINERY

	May 1922	June 1922
Lathes	$66,604	$84,198
Boring and drilling machines	69,424	68,580
Planers, sharpers and slotters	17,590	52,280
Bending and power presses	15,806	31,531
Gear cutters	6,174	15,937
Milling machines	25,255	51,622
Sawing machines	2,930	6,678
Thread cutting and screw machines	17,668	17,290
Punching and shearing machines	12,610	20,685
Power hammers	13,188	3,162
Rolling machines	16,270	585
Wire-drawing machines	2,248	3,152
Polishing and burnishing machines	83	894
Sharpening and grinding machines	83,304	69,297
Chucks, centering, lathe, drill and other	26,028	13,605
Reamers, cutters, drills and other parts for machine tools	113,696	110,007
Pneumatic portable tools	18,930	30,687
Foundry and molding machinery	75,887	53,447
Other metal-working machinery and parts of	308,383	813,229
Total metal-working machinery	$892,078	$1,446,866
IMPORTS		
Machine tools	$29,977	$26,599

Record Auto Output for July Indicated

Shipping reports to the National Automobile Chamber of Commerce, 90 per cent complete, indicate that July shipments from all factories will reach a total of 28,412 carloads, 28,022 driveaways and 6,855 boats.

On this basis it is estimated that 246,600 passenger cars and trucks were produced by all makers in July, exceeding July, 1921, by 39 per cent and the best previous July (in 1920) by 20 per cent; the decrease under June, of 14 per cent, is seasonal and expected. This is a record for production in July and is the third largest single month's production in the history of the industry, being exceeded only by the two preceding months.

Legion of Honor for Dr. Kennelly

For distinguished services as exchange professor in engineering to the French Republic, the Cross of the Legion of Honor has been awarded to Dr. A. E. Kennelly, professor of electrical engineering at Harvard University and the Massachusetts Institute of Technology.

Dr. Kennelly was the first exchange professor sent to France from America under the scheme of regular annual exchange of professors in engineering and applied science, inaugurated last fall between the French University Administration and seven American institutions.

The French representative in America, Professor J. Cavalier, director of the University of Toulouse, and an authority on metallurgical chemistry, has recently returned to France after a year spent at the seven co-operating institutions, Columbia, Cornell, Harvard, Johns Hopkins, Massachusetts Institute of Technology, Pennsylvania and Yale.

Professor Kennelly is the third American engineer thus to be honored recently, the others being Colonel Arthur S. Dwight, president of the American Institute of Mining and Metallurgical Engineers, and Charles F. Rand, chairman of the Engineering Foundation. He will be succeeded this year as American exchange professor by Dean John Frazer of the University of Pennsylvania, now in France. Professor Cavalier's post in the seven American universities will be filled by Dr. M. E. deMargerie, director of the Geological Service of France.

Employment Service for Engineers

An employment service for engineers of every variety of training and experience is conducted by the four national engineering societies of the United States. This service brings in touch with the various business men the services of 50,000 trained technical men who are members of these societies and one of the objects of it is to show to the various commercial houses the aid which engineers are rendering to others in the same lines and to help these firms and corporations secure similar assistance.

Men of engineering training are prominent in all branches of commercial endeavor and their creative ability is recognized as being of great help in the building up of the nation's wealth.

This service is in a position to supply chemical engineers, civil engineers, mechanical engineers, electrical engineers, sales engineers, production managers, superintendents and other trained executives, and is under the direction of W. V. Brown. The office is located in the United Engineering Building, 29 West 39th St., New York City, and is free to employer and employee.

Business Conditions in Germany

By OUR BERLIN CORRESPONDENT

AFTER the negative result of the Genoa conference and the bankers conference, the critical conditions visible for some considerable time, are perceptibly becoming more and more accentuated. In the public's opinion the country's business has entered into an era of crisis, opposing interests working to gain control. The fear of the impending impact is casting a gloomy spell over the country. For the last seven or eight months the population had been hoping for financial improvement, and the business world has shaped its course accordingly. Especially with regard to the bankers' conference, a favorable outcome resulting in a large loan was commonly expected, even to the extent of full conviction in quarters where carefully formed opinions and even scepticism prevails as a rule. Such general expectations, which, if realized would have marked results upon every phase of business life, could not fail to hold in suspense numerous arrangements of even the most pressing nature. When they ultimately broke down, a state of affairs ensued resembling the bursting of a dam, the combined effect of the long restrained business actions gravitating towards an outlet and, indeed, lending to the situation all the signs of a severe crisis.

Stringency of Capital Acute

The most threatening conditions by which industry is now faced are the stringency of capital, the shortage of material, and the growing unrest among the laboring class.

The stringency of capital, the causes of which have already been explained in these columns has, during the last two months, taken alarming dimensions. Banks were compelled to reduce their rate of credit on securities and these have declined steadily in value. The same can be said of all other forms of collateral. Credits are, indeed, strained to the utmost. Under such conditions it is not surprising that numerous manufacturers have delayed covering themselves with raw material, especially the imported kinds, hoping that a large loan to the country would relieve the financial strain. Upon the sudden realization of the vainness of such hopes, a general rush took place, and this is largely responsible for the recent financial landslide. Storm and stress having created a disposition in the population, including the leading business men, to go from one extreme to the other, it is believed that experiment to support the mark has broken down, and that there is nothing more to prevent its complete collapse.

The immediate effect upon industry of this state of affairs is that large quantities of raw material needed for orders in hand and partly paid for have to be bought now at prices entirely out of keeping with original estimates. Even if the money for these purchases can be found in all cases, which is extremely doubtful, great difficulty will be encountered later on in the matter of prices. It is true that most domestic orders and part of the orders for export are placed upon a sliding scale, but the agreed-upon stipulations of the scale do not take care of such contingencies as the neglect of the manufacturer to provide himself with the raw material needed at the time of receiving the order. If the latter does not succeed in unloading the increase of price upon the purchaser, he will be faced either with the loss of money or of orders. The latter could, no doubt, be sustained more easily, and the tendency is to retreat in this direction.

It is commonly estimated in business circles that the stringency of capital will last until the vast sums now being tied up in enormous quantities of goods in the course of manufacture have reached the consumers, provided that the latter are not then inclined to place further orders of equal size. Hardly any fear is felt on the latter account, and for this reason a release of tied-up capital is generally expected next fall. As an alternative is hoped that foreign capital will flow into the country in the shape of investments in industry, attracted by the extremely low quotations on all industrial stocks. Industry urgently needs fresh capital to an extent which, in the light of statistics, appears to be no less than 20 to 50 billion marks. In the first five months of this year the joint stock companies, which represent nearly 80 per cent of industry as a whole, only received 15 billion marks, compared with nearly 9 billion marks for the same period of last year. In the capital demands of industry, the machine building industry occupies, by far, the front rank. It has required 2½ billion marks of fresh capital during the first three months of the year. When taking into account that the purchasing power of money since last year has decreased from 25 to 30 per cent, and that, on the other hand, the industrial activity has nearly doubled, the cramped condition of industry can be realized. Under present conditions there appears to be no way out of the difficulty. Even the usually strong support lent to manufacturers by the banks has weakened considerably.

Shortage of Raw Materials

Almost in the same proportion as the stringency of capital, the shortage of raw material has increased along the entire list, starting with fuel. The shortage of coal which, in public discussions of the situation forms the chief topic, is said to be caused by the drop in the production of Ruhr coal and by the division of Upper Silesia. The dimensions which the imports of foreign coal have taken lately, running up quickly in the case of British coal to the pre-war average, have further accentuated the growing difficulty. Nevertheless, the shortage of coal is somewhat exaggerated in connection with the new adjustment of the coal tribute now under consideration.

More pronounced is the shortage of iron, steel and other metals. It is being stated that numerous machine tool building works, crowded with orders, have had to reduce working time on this account. The shortage of iron and steel is attributed to the mills being handicapped for lack of fuel, but this can only apply to the present hand-to-mouth conditions, and could have been obviated by better foresight on the part of the producers. Lack of raw material is, in the first instance, caused by the enormous industrial activity which has not been foreseen and taken care of in proper time. In fact, the present time can be taken as a test of the capacity of German industry. It can be clearly seen that the utmost limit of this capacity has been reached or even passed. The rate of production is estimated at only 60 per cent of pre-war production, and this can be taken as the present standard of capacity. This standard coincides with the efficiency of the workman. According to a statement made recently at the annual meeting of the German machine tool building works, this efficiency last year was 60 per cent, and has even dropped during the second part of the year. As further accentuating the strained situation of the industry there has been added lately a shortage of labor. Complaints on this score are coming chiefly from the mining districts and also from the metal trades.

Labor Situation Threatening

The strong revival in the building industry, drawing workmen to it by high wages, is the chief cause. It appears, indeed, that if all lines of work are to be kept going at the present rate of production, the amount of labor available in the country will be insufficient. The relief coming from the emigration of workmen of German nationality from the Polish part of Upper Silesia which has taken place lately is too slight to cause a marked difference. The chief difficulty of the labor supply is the housing problem.

The third, but by no means the least important of the threatening conditions prevailing, is the labor situation. The latter is chiefly ruled by the control which, so far, has been exercised upon living cost. Recent developments have shown that the theory held out some time ago that this control has broken down is not far from the truth. At no time since the armistice has the upward movement of prices been anywhere as rapid as during late months.

According to the index of living costs, the latter increased 20 per cent in April as compared with March, and 9 per cent in May over April. From May to June a further large increase has taken place. The living costs for May were 35 times higher than the pre-war level, and the cost of food is 47 times higher. The increase in wages of machinists during the same period can be seen from the following figures, giving the wages per week:

	July, 1914	May, 1922
Trained Machinists		
Bachelors	42.44-M	825-M
Married men	(Not Given)	1,011-M
Half Trained Workmen		
Bachelors	39.96-M	791-M
Married men	(Not Given)	977-M
Untrained Workmen		
Bachelors	30.62-M	772-M
Married men	(Not Given)	958-M

These figures apply to conditions in Berlin. In a few other towns they are higher, but in the majority of lo-

(*Continued on page 280b*)

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

BY THEODORE H. PRICE
Editor, *Commerce and Finance*, New York
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MINNEAPOLIS, MINN.

REALIZING that business prosperity or depression is largely a matter of popular sentiment or feeling I am on my way across the Continent with the purpose of ascertaining, if I can, how the people of this country feel in regard to the future. Thus far I have visited Chicago, St. Paul and Minneapolis. In each of these cities I have had opportunity to talk with many prominent men, including not a few highly placed railroad officers. They are all optimistic. The merchants say that most of the crops are good, that they have been economically produced, that they are bringing fair prices and that the farmers are and will continue to be liberal buyers. An active trade, at least until well into the autumn, is therefore generally expected.

Confidence does not seem to be perceptibly disturbed by the certainty that there will be a coal famine unless the coal strike is soon settled. The present and prospective scarcity of coal is indicated by the receipts from April 1 to July 31 at Duluth and Superior, from which ports most of the fuel supply of the extreme Northwest is distributed. The figures compare with previous years as follows:

	Tons		Tons
1922.....	397,210	1921.....	6,233,000
1920.....	2,345,000	1919.....	5,340,000
1918.....	3,669,000	1917.....	3,430,000

This showing is ominous, but the feeling of the community is expressed by one man who said that he had heard coal famines talked of all his life but that he had never seen one and did not expect to. The conference at Cleveland, even though only 20 per cent of the operators in the central field are represented, holds out hope for an earlier settlement of the strike than seemed possible a week ago, and once even part of the operators agree on terms the settlement is likely to spread.

As to the railroad strike the executives seem to regard the fight as won. They say that the men will tacitly waive the seniority question, pending decision by the Labor Board in accordance with the President's proposal, that the strikers will have learned that in future strikes they cannot keep their cake and eat it too, and that the result will be immunity from labor troubles for some time to come.

There has been surprisingly little delay in moving either freight or passengers in this region and as there is every prospect that the autumn traffic will be enormous the officials are all cheerful and the outlook for the transportation industry is better than it has been for a long time.

The banks report that there is an abundance of money, that old accounts are being rapidly collected, that the frozen credits are being thawed out and that financial conditions generally are easier than they have been since 1920 and sounder than then because there is not yet any over speculation.

In the West as in the East high rents, high taxes and the probability of high priced coal are bitterly complained of but in so far as the Northwest is concerned it seems unlikely that for the present or the immediate future anything short of a cataclysm can seriously disturb the confidence that is so pervasive and one is impelled to conclude that in so far as both mental and material conditions are concerned the indications are in the main highly reassuring.

The bumper crops forecast by the August report will add at present prices well over a billion dollars to the farmers' purchasing power as compared with 1921, and if there is, as many expect, an advance in the prices of wheat and rye this figure will be increased materially. The gain in what the farmers will receive amounts to about 20 per cent, which is considerably more than the average increase in the things they have to buy.

If there is no setback in the condition of the crops, therefore, business in the farming states is likely to be even better than most merchants expect. The most authoritative reports obtainable indicate that retailers' stocks are small, and as these facts become generally appreciated the conservative hand to mouth buying which is now the rule is likely to give way some time during the fall to a spurt which will advance prices sharply. In any event buyers are likely soon to begin placing their orders for two to three months' supply of goods instead of filling only their immediate needs.

The First National Merchandise Fair, which is the first trial in this country of an ancient marketing method still widely used in Europe, has been opened, apparently with great success. It has brought an unprecedented number of buyers into New York, and they seem confident that business will be good during the fall. The lessons of the past eighteen months, however, have taught them super-conservatism, and many are disposed to limit their buying, I think, too closely, forgetting the scramble which will follow if all discover that they are understocked at the same time.

Candidates who advocate the soldiers' bonus are making poor showings in the primaries, and perhaps this demonstration that support of the largesse is not a sure step to political preferment may turn Senatorial sentiment away from it. Like the ship subsidy, however, the issue is still to be fought out. Meanwhile it is worth noting that the states have by no means completed their contemplated financing to pay bonuses to their own soldiers, and in so far as this is a factor contributing to "secondary inflation" its effects have not worn off.

Colonel Ayres, of the Cleveland Trust Co., has made an interesting study of previous depressions which shows a remarkable similarity in the course of bond prices during recovery. Taking the lowest point of pig iron production as the bottom of depression he has discovered that bond prices uniformly reached their peak about fourteen months later. Should this be true of the present recovery the peak would be reached in September. Colonel Ayres of course knows that the precedents of the past do not always govern the present and future, and he is too sagacious to predict that the interval will be the same in this instance, but as a "take it or leave it" statement his conclusion is particularly interesting because there are other factors which seem to support it, particularly the trend of the money market.

Analysis of the loans and investments of the member banks of the Federal Reserve System shows that in the past fifteen months there has been a decrease of about $1,250,000,000 in the total of commercial loans, and an increase of about $1,150,000,000 in the total of their security holdings or loans based on securities. This has been accompanied by a steady advance in bond prices and a decline in money rates, and it is reasonable to suppose that when commercial loans start increasing again the trend will to some extent be reversed.

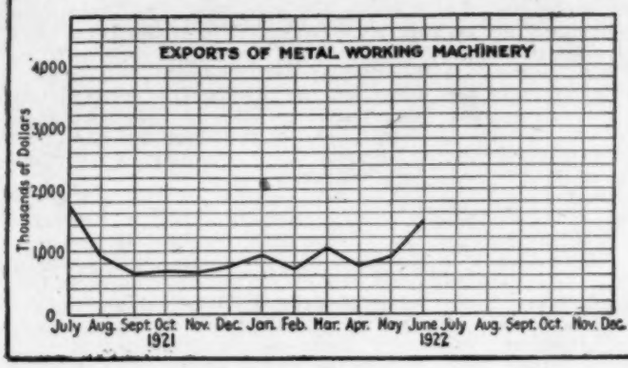
If, as everyone expects, this increase in commercial loans first becomes marked in the autumn the rise in bonds is likely to be stopped concurrently. Nevertheless they need not be expected to decline greatly. Colonel Ayres' study shows that in the past they generally entered a period of comparative stability. The peak of stock prices was not reached until some time afterward.

I am informed that a number of large investors, including banks, intend to handle their bond holdings in accordance with this theory, and if there should be enough profit taking it would produce exactly that halt in prices which Colonel Ayres' conclusion indicates.

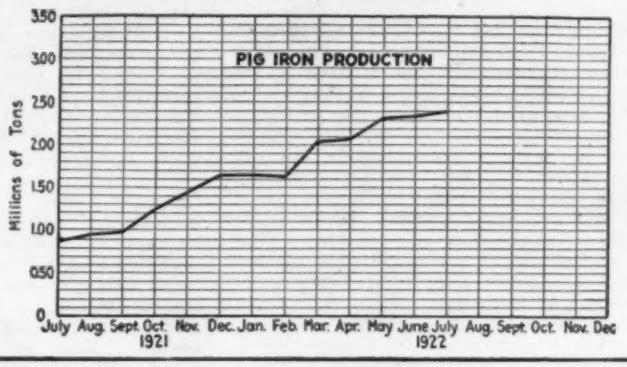
The Federal Reserve statement for the week re-emphasizes the certainty of ample funds to sustain commercial expansion. Due to a decline in rediscounts the reserve ratio is up to 80.4 per cent, the highest since the spring of 1917, though gold holdings are virtually unchanged.

American confidence seems impervious both to the strikes and to anything which happens as far away as Germany. And in nearly all respects, save the outlook abroad, this faith and confidence, which are just as important ingredients of prosperity as actual conditions, seem to be warranted.

Total value of all metal working machinery exported monthly from the United States, based on returns compiled by the Bureau of Foreign and Domestic Commerce.



Monthly pig-iron production of all coke and anthracite furnaces in millions of tons, based on returns compiled by the American Iron and Steel Association.



AMERICAN FOREIGN TRADE figures for June from the Department of Commerce show total imports to the value of $260,390,000 and total exports valued at $327,198,000. In both, there is an increase over May. Chiefly is the increase in imports made up of raw materials or partly finished goods. In manufactured goods ready for consumption there is only a slight increase. On the other hand our foreign sales of manufactured goods show an increase of over nine millions.

British foreign trade figures for June show two facts of interest. Her imports of raw materials, valued at £69 millions is not merely equal to, but is slightly above the 1913 average. Her exports of manufactured goods, on the other hand are but slightly more than half of her pre-war volume.

Railroad earnings for June, according to the final report of railway operations shows 199 roads out of 200 in Class 1, having a net operating income of $76,470,500, equivalent to a return of 4.78 per cent on their tentative valuation. In the same period of last year, the net income of these same roads totaled $50,984,000 or an annual return of 3.18 per cent. For the first six months of 1922 the net operating income of the carriers totaled $348,387,400 as compared with $145,639,800 during the same period of last year, or a return of 4.43 per cent per annum as against 1.85 per cent in the first half of 1921.

Comparative Prices of Shop Supplies

Average of New York, Chicago and Cleveland Prices

	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0263	$0.0252	$0.0278
Cold finished shafting	per lb.	0.0340	0.0335	0.0428
Brass rods	per lb.	0.165	0.1550	0.159
Solder (½ and ½)	per lb.	0.22	0.213	0.18
Cotton waste	per lb.	0.11	0.11	0.122
Washers, cast iron (¼ in.)	per 100 lb.	4.00	3.83	4.06
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.11	3.11	.....
Lard cutting oil	per gal.	0.575	0.575	.....
Machine oil	per gal.	0.36	0.36	.....
Belting, leather, medium	off list	40–5% @50%	40–5% @50%	
Machine bolts up to 1 x 30 in.	off list	55% @60%	50%@ 65–10%	50%@ 60–10%

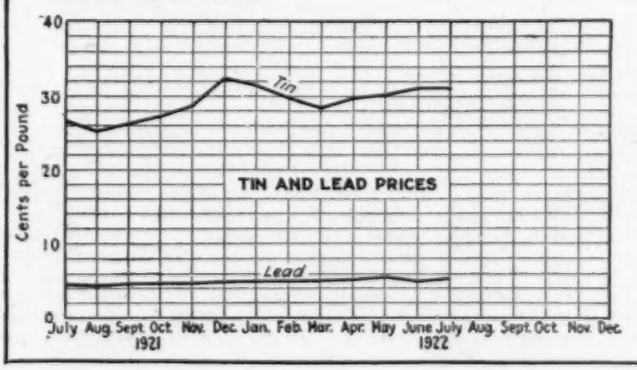
Unfilled tonnage on the books of the U. S. Steel Corporation on July 31, increased 140,630 tons over June. The forward orders totaled 5,766,161 as against 5,635,531 tons on June 30.

The increase however, is only about one-third of that recorded in June over the month of May. With the exception of February which showed a decrease of 100,000 tons, every month of the current year shows an increase, although a decrease because of the strike situation, is expected during August.

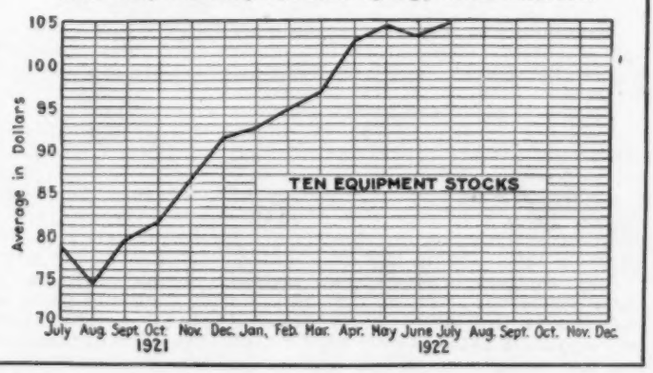
Loadings of revenue freight on American railroads for the week ending July 29 totaled 859,733 cars as compared with 861,123 in the week previous. Compared with the corresponding week of last year there is an increase shown of 64,301 cars, but the figure shows a decrease of 76,633 as against the same period of 1920. Coal loadings increased 314 cars over last week but decreased 73,065 cars as compared with the 1921.

Freight cars idle on American roads on July 23 because of business conditions, totaled 382,322 as compared with 417,029 in the week previous. Of the total 198,322 were cars in good repair in excess of the current requirements. The remainder, 184,000, were bad order cars in excess of the normal unfit for service. Contrary to the general impression, the number of locomotives in bad order is not excessive. On July 15 there were 15,764 in need of repairs as compared with 15,437 on July 1, 1921.

Monthly average price of tin and lead in the New York market, based on returns furnished by Engineering and Mining Journal-Press.



Monthly average: Am. Brake Shoe; Am. Car and Fdy.; Am. Loco.; Baldwin; Lima Loco.; N. Y. Airbrake; Pressed Steel Car; Pullman; Ry. Steel Spring; West. Airbrake.



Business Conditions in Germany

(*Continued from page 279*)

cations they are lower. In the case of trained workmen the increase, since pre-war times, is 24 times greater and in the case of untrained workmen it is 31 times greater. With the exception of a few vocations the foremost of which are the mines and the building trades, the wages have not kept pace with the increase in living costs. Great efforts are being made to preserve the proper ratio between the two but in view of the growing discontent prevailing among the labor classes, the success is doubtful. The time does not seem to be far off when the labor situation will have to be grappled with seriously. The employers are trying to solve the problem by increasing the working time, while the workmen, on the other hand, are centering their efforts more and more upon sliding scales of wages. The gulf separating these two objectives is so wide that it is difficult to see how it can be bridged. The employers in their opposition to sliding scales of wages are able to point to the bad experience in Austria, where such scales led to a state of affairs in which neither side has profited and industry is losing ground steadily. The strike fever is growing perceptibly, and the impending labor conflict is becoming more and more pronounced.

Machinery Industry Stagnant

Viewed from the outside, no material change of the state of business could be seen until a few weeks ago. In addition to the numerous orders held in abeyance pending the outcome of the various conferences, business has increased from April to May. The same applies to the rate of employment according to the official returns given by the Labor Ministry. As far as machine building is concerned, it was stated that in May 77 per cent of all works were employed to fullest capacity and 23 per cent were only a little below full production. This is exceptional, and reflects a state of affairs not experienced since the war. That such appearances are deceptive has lately been stated by the leading men in industrial affairs.

At many meetings of industrial associations gloomy views of the future prevailed. In the meeting of the National Association of the German Industry, the president of the association, Dr. Karl Sorge, managing director of one of Germany's largest machine building works, prophesied a stagnation close at hand on account of the decreased purchasing power of the domestic market. The keynote of his speech was that once German industry has to reckon with world market prices and compete with them, it will begin to realize the height to which costs of production have risen. The change in conditions already mentioned as having taken place recently, has not yet taken effect sufficiently to enable one to judge its tendency and dimensions. It has, however, made its force felt already on several important lines in the machine building industry, the foremost of which is the machine tool building.

According to information received from numerous works, the drop in business in the latter is marked and universal. It extends over all lines of machine tools equally. It is, at the present time, difficult to say whether this change is a reaction of a transitory character or the first stage in the prophesied slump. Manufacturers are hoping that the recent decline of the mark will again call buying into activity, but if what has been stated repeatedly from authoritative quarters is true, that the purchasing power of the domestic market is for the time being impaired by the stringency of money, such a hope could only be realized by a revival of export activity. Judging from the experience gained during the last twelve months, which shows that the demand from abroad hardly follows the rise and fall of exchange, such a hope seems rather idle. According to the reports of the machine building associations, amongst them the Society of German Machine Tool Builders, exports amount to hardly more than from 20 per cent to 30 per cent of the total production. From January to April the total machinery exports have increased from 33,000 tons to 39,000 tons, but judging from preliminary reports of the May and June business, a drop has taken place during this period.

This decrease is already visible in the case of machine tools which, as a rule, are leaders in the business fluctuations in the machinery market. From 7,336 tons in February, machine tool exports have dropped in March to 6,800 and in April to 5,800 tons. The total of machine tool exports during the first four months of the year was 27,000 tons compared with 23,700 tons in the same period in 1913. From the latest reports of export business it appears, however, that the official returns on machine tool exports have included wood working machinery. Deducting the latter from the total of machine tools, it appears that the April exports were only 4,300 tons compared with 5,900 tons in April, 1913. Deducting wood working tools which, probably, during the first four months of the year were 5,000 tons, the total volume of exports was somewhat lower than in pre-war times.

With regard to export prices of machinery, the statistics show that some progress has been made in raising them with the depreciation of the exchange, but not in the same proportion. The total of machinery exports during January-April, 1922, were valued at 5 billion paper marks, which is 34,400 paper marks per ton, compared with a pre-war average of 1,200 gold marks. The average depreciation of currency during the same period was 1 to 60. In the case of machine tools, the average during the first four months of the year was 25,000 marks, and in April 40,000 marks. The pre-war average, at the rate of exchange prevailing during April would equal nearly 80,000 marks per ton, or almost double the actual price received.

Machine Tool Export Prices

From statistics it is apparent that the directions given by the Association of German Machine Tool Builders for quoting export prices are not properly observed. According to these directions the average price per ton in April should have been 54,000 marks per ton. By way of explanation, manufacturers as well as dealers state that they find it more and more impossible to enforce these directions to the full extent. Speaking of these directions, the rate of increase over November prices has, from May to June, been raised by from 120 to 145 per cent.

The death of Dr. Rathenau has been a severe blow, not only to Germany as a whole but particularly to German industry. In fact it is in the latter field that his chief excellence lay, as even his many enemies admit. The development of the Allgemeine Elektricitäts Gesellschaft (General Electric Company), whose president he was, is a monument to his foresight as an industrial leader.

The organization of the A.E.G. is, doubtless, one of the best in Germany. One of the chief features is the independence of the various departments of each other, giving managers a free hand to procure from outside sources articles manufactured by the company itself if its own product cannot compete in the way of prices. The stimulus thus imparted to the various departments of the company has never failed to work. In spite of such qualities, Dr. Rathenau had many enemies, not only in political circles but also in industrial affairs. His late policy was to bring about an improvement of the mark and its stabiliztaion, even in the face of the severe crisis threatened thereby to industry, recognized, doubtless, by him as well as by others. The opposition encountered from his brethren was chiefly centered on the contention that the time for going through such a crisis had not yet come, and that temporizing was the thing most needed.

Reparations and Russia

In view of the stagnation in export business, some attention is now again being devoted to the reparations question. No progress has been made in this respect in spite of various agreements concluded. The latter have not been ratified, and must, for the present, be considered shelved. Of actual supplies made for the reparations' account, the chief place is occupied by coal, coal by-products and chemical products. Machinery so far has been entirely neglected. Although France and Belgium are among the chief foreign buyers of German machinery, these products have been supplied only in the course of regular export business.

No material progress is being made in the furtherance of the Russian business, although preparations are being conducted with great vigor. The experience gained from trading with the export department of the Soviet Republic is most disappointing. In many cases it has turned out that the goods to be supplied by Russia in exchange for German goods are not available for shipment, being tied up by some community or co-operative society. It has been found necessary to deal with the latter separately and this, in many cases, has resulted in better and quicker business. For this reason the actual official returns from Russian export business to Germany in no way reflect the total volume of business transacted. The official transactions in the second half of 1921 comprised goods to the value of only 200 million paper marks, and in the first quarter of the current year 105 million paper marks. Flax and wood were the chief imports. A complete re-organization of Russian foreign trade is said to be in the course of development, consisting, in most cases, of companies in which the Russian State as well as foreign capitalists are shareholders.

Washington Notes

By Paul Wooton

To keep alive in such times as these the requisite knowledge of, and skill in, the mechanical arts peculiar to ordnance manufacture is a very serious problem, General C. C. Williams, the Chief of Ordnance of the Army, points out. With the principal nations well stocked with ordnance material, private manufacturers of these articles are without orders and their shops are closed down, says General Williams. There are no prospects that they will receive any orders for many years to come and as a result the whole burden of keeping alive the very exacting art of ordnance manufacture in this country has fallen upon the Government.

During the current fiscal year the Ordnance Department's appropriations have been cut $3,000,000 lower than the average appropriations during ten pre-war years, that is from 1904 to 1914 inclusive. Despite this handicap every effort is being made to apportion just as much of the money as is possible to work at the arsenals. Arrangements have been made whereby all of the manufacturing arsenals will be kept in operation during the next year. While the force at these ordnance manufacturing plants is simply a skeletonized organization, it will make possible the preservation of a certain amount of skill which must be kept alive, General Williams says. In addition it allows a certain amount of development work to go forward.

Just at this time the Ordnance Department is giving particular attention to the development of an automatic loading shoulder rifle. The advantages that come through no interference with aim such as is caused when a bolt must be operated to reload are so great that General Williams regards it as certain that this will be the next step forward in shoulder rifle development. He reports that highly satisfactory progress is being made in the development of aircraft bombs.

A patent infringement suit involving the unitary oscillating magneto ignition equipment employed upon practically all stationary and portable gasoline engines is before the Supreme Court for decision. The case was brought on appeal by the Webster Electric Co., against the Splitdorf Electrical Co., from the Circuit Court of Appeals for the 7th Circuit. The lower court declared the patent in question was void, while the Webster Co. contends that if this ruling is sustained it will act to invalidate half of the U. S. patents in existence. The Webster case is based on an alleged infringement by the Splitdorf Co., of the Kant patent granted September 24, 1918. The district court found the patent valid and infringed but it was reversed by the circuit court. The circuit court gave two opinions in the first of which it declared the patent void for want of novelty. On rehearing the court admitted error in the first opinion but held that while the patent is a novel and meritorious invention, it was invalid because it was not formulated and presented in the patent application until shortly before its allowance.

In a House speech discounting alleged disadvantages under which American ships operate as compared to foreign ships, Representative Hardy of Texas, in opposing the ship subsidy bill, stated that much of the cost of ships comes from complicated and expensive machinery but that our manufacturers of machinery have shown "that in almost every line they can hold their own in the markets of the world." He stated that the oil burner and the Diesel engine are effecting as great a revolution in shipping as the displacement of wooden ships by iron ships did in the fifties of the last century. The economies affected by this new fuel and machinery, in operation and cargo space and greater speed and quicker turn around are marvelous, said Mr. Hardy, and it will take a long time for the other nations to junk their existing coal burning fleets, while the United States can fairly start with the new era. As to the high labor cost of operation of ships, Mr. Hardy said the labor cost is not more than 8 to 12 per cent of the total cost of operating an American coal burning ship. That percentage will be lessened, he says by the use of oil burners and the Diesel engine and when this class of ships comes in competition with coal burners, which constitute the bulk of foreign shipping, the percentage of labor cost to the whole cost of operation will be less on American ships than on foreign.

Unreasonable rates on machinery from various points to Omaha are alleged in a complaint to the Interstate Commerce Commission by the Metropolitan Utilities district of that city.

Senator Harrison, of Mississippi, has introduced by request of Senator King, who is in Utah, a resolution calling for a report by the Interstate Commerce Commission as to whether the acts of Congress requiring railroads to equip their locomotives with safe and suitable boilers and calling for regular inspection of boilers, is being violated. The resolution was referred to the Senate Committee on Interstate Commerce for consideration as to the feasibility of calling on the commission for a report.

Germany Again Buying Our Copper

A sign of good omen in the copper situation is found in a recent announcement that the Copper Export Association has just drawn for redemption $3,000,000 of their 8 per cent gold notes of series "B," and $6,000,000 of their 8 per cent gold notes of series "C" to be paid on August 15, 1922.

For the fiscal year ending June 30 the figures, it is reported, will show approximately $90,000,000 have been realized in the sale of copper to foreign consumers, the greater portion of which has been handled through the association.

Of interest, chiefly, as bearing out past history, has been the exports of the red metal to Germany. As in the pre-war days, she has been the mainstay of the foreign demand, taking and paying for more than $30,000,000 worth of copper in cash. In the past two years she has taken more than $50,000,000 worth of the metal.

Export shipments for the month of May were 58,085,033 pounds as against 62,196,956 pounds in April. The total exports for the entire year of 1921 amounted to but 32,259,011 pounds.

Southern Industrial Conditions

The Southern Metal Trades Association from the Atlanta headquarters announces that the railroad strike has not as yet slowed up industrial operations in the Alabama district to any material extent, and that most of the manufacturers believe a settlement will be reached before the situation becomes serious. The plants are continuing unabated production the only difficulty being in getting products to market.

The end of July found 23 furnaces operating in Alabama, the largest number that have been active at any time in that district since the period of depression began almost two years ago. Several furnaces started up in July.

The base price for No. 2 foundry iron is $19 to $20 with most makers asking the $20 price. Encouragement is found in the recent action of the Louisville and Nashville Railway and the Southern Railway. These two roads have formally announced that the new and lower rates on Birmingham pig iron to Cincinnati and St. Louis will go into effect Sept. 1. The present rates are $4.05 and $5.17, while the new rates will be $3.53 and $4.22, respectively.

All industrial operations over the southeast continued upward during July but the pinch of the strike is now beginning to assume more serious proportions in the district, causing a material shortage of cars.

China Also Having Its Labor Troubles

According to reports from the Far East, the lowly Chinese wage-earner, perhaps the most abject of all the world's toilers, is just learning of the power he is able to wield through the medium of organization, and like a great flood the movement to form various trade guilds is sweeping the country.

It was hardly more than a year ago that China witnessed its first important strike. Since then the larger cities have experienced walkouts in almost all classes of work, with the result that business is demoralized, transportation is so uncertain that merchants refuse to ship, and in many cities the public health is menaced through strikes of street and water-works employees.

At the present time in Canton the carpenters, painters, school teachers, butchers, street sweepers and city employees are on strike, while the seamen and launchmen, who but recently returned to work, are on the verge of another walkout. The City of Macao is in the thick of a general strike which is almost a state of siege. The casualties to date have been forty killed and nearly 200 injured.

The seamen's strike here has had a tremendous effect all over the Far East, as it has given the laborers confidence in their new guilds and stimulated their desire for better living conditions. The seamen have been so successful in forcing their demands that they now talk of going into the shipping business for themselves. The men are being asked to subscribe $5 each, and judging from the eagerness with which they are responding the backers of the project expect soon to have a steamer running between here and Canton.

Business Items

The Bay State Tap and Die Co. has taken over the plant of the Blancke Twist Drill Co., Taunton, Mass., which went through bankruptcy about a year ago, and will, it is reported, start operations about September 1.

The C. C. Carter Machinery Co., dealers in machine tools and supplies, has moved from 36 Garnet Street to its new quarters at 150 Chestnut Street, Providence, R. I.

The Bull Dog Lock Washer Co., Baltimore, Md., has arranged to increase its capital to $225,000, the funds to be issued for proposed expansion.

The Metallic Press Cloth Co., Augusta, Ga., which recently established a plant in that city, is now manufacturing a metallic press cloth recently invented by William A. Lee, of Augusta, which cotton oil mill superintendents have approved as an invention of decided importance to this industry.

The Semet-Solvay Co., Ensley, Ala., has fired up sixty additional coke ovens which, with 240 ovens already in operation, brings production up to a full 100 per cent.

The Georgia State Legislature has before it at the present time a bill, which has been favorably reported in the current session, designating Savannah, Ga., as the official state port, and authorizing the investment of $15,000,000 for the establishment there of state-owned and operated port terminals, warehouses, etc.

The Chicago Flexible Shaft Co. announces that the address of its New York office for Stewart Industrial Furnaces, which has been located at 350 Broadway since it was established early in 1920, has been changed to 16 Reade Street. The office, as before, is in charge of J. W. Lazear.

The Ricker Machinery Co., Seattle, Wash., has been incorporated with a capital of $25,000 by James W. McBurney, Hoge building; E. M. Ricker, H. J. Armstrong and Jas. W. McBurney, all of that city.

The Jones Machine and Tool Co., Philadelphia, has purchased ground at Primos, Pa., and begun work on a building. Employment will be given to 150 men. The pattern and designing shop, under construction, will be followed by other shops.

The Lockport Foundries Corporation, Lockport, N. Y., has announced that it has acquired control of the Jefferson Union Co., Lexington, Mass., manufacturers of pipe fittings, and that plans are under way for the erection of additional buildings.

The Hartford Tap and Guage Co., Hartford, Conn., has recently filed a certificate with the Secretary of the State of Connecticut to change the name of the company to the Hanson Tap and Guage Co. The directors and officers of the company remain the same, and there will be no other change at this time.

Van Vleet, Inc., Hedden Place and North 15th St., Newark, N. J., has been organized with an authorized capital of $125,000 for the purpose of conducting auction sales of machinery, industrial and manufacturing plants and work of appraisal. The officers of the company are B. Dorf, president; S. H. Berger, vice-president and Herbert Segal, treasurer.

The Mount Vernon Machine and Motor Co., Mount Vernon, Ill., has filed notice of change in name to the Davis-Settlemire Co.

The Hubbard Oven and Manufacturing Co., an Illinois corporation, has filed notice of organization to operate in New York with a capital of $200,000. C. S. Sharp, 260 West Broadway, represents the company.

The Board of Commerce, Bay City, Mich., is negotiating with the Michigan Central Railroad Co., Detroit, regarding the erection of its proposed new main car shops on local property. A site has been selected and inducements have been offered to have the plant established here.

The McKinley Hardware Co., Rock Island, Ill., has arranged for an increase in capital from $10,000 to $50,000.

The American Cylinder Grinding Co., Newark, N. J., has filed notice of organization to operate a works at 682 South Eleventh Street. A general machine shop will be conducted.

The Dasco Spring Cover Co., Allston, Mass., will commence the operation of a new works on the second floor of the Wilcox Building, Athol Highlands, Athol, Mass., recently acquired for this purpose. The company will manufacture spring covers for automobile service.

The Ajax Bolt and Screw Co., 1571 Wellington Street, Detroit, Mich., has arranged for an increase in capital from $25,000 to $200,000.

The Hercules Trailer Manufacturing Co., Los Angeles, Cal., incorporated in April of this year with a capital of $50,000, and now producing Hercules trailers in its new plant at 1327-33 Santa Fe Ave., has elected the following officers and directors: Charles H. Mason, president and manager; A. C. Pferdner, secretary; G. A. Morton, treasurer and engineer; C. A. Herberts and Major Whittingham, directors.

The Malco Products Corporation, 220 West South Temple St., Salt Lake City, Utah, is equipping a modern plant to manufacture automobile accessories as well as to do experimental and contract work requiring stamping, blanking, shaping and spinning. It desires to receive advertising literature and catalogs from tool and machine builders.

The Wisconsin Electric Co., manufacturer of Dunmore electric tools, Racine, Wis., has established offices for the New Pork and Northern New Jersey districts at 27 Warren St., New York City with E. S. McGonegal in charge as sales representative.

The Sullivan Machinery Co., Chicago, Ill., has recently purchased 125 acres of ground at Michigan City, Ind., where it is planning to erect buildings and shops for a new and greatly enlarged plant. Upon completion of the proposed construction, the buildings comprising the Chicago plant of the company will be sold after the equipment has been moved to Michigan City. The company plans, however, to retain its present office headquarters in Chicago, Illinois.

The North & Judd Manufacturing Co., New Britain, Conn., one of the largest manufacturers of hardware tools, etc., in the east, held its annual stockholders' meeting during the past week and elected the following officers for the ensuing year: H. C. Noble, president; E. M. Wightman, vice-president and secretary; F. M. Holmes, vice-president and treasurer; Samuel MacCutcheon, assistant secretary; and Frederick J. Ward, assistant treasurer. The directors chosen were: F. S. Chamberlain; George C. Clark, Charles Glover, F. M. Holmes, G. M. Landers, H. C. Noble, A. J. Sloper, and E. M. Wightman.

Personals

W. F. TRENARY, of Atlanta, Ga., inventor of the pump bearing his name, has been granted a patent for certain improvements on the Trenary centrifugal pump, which prevents leakage, retains the priming and protects the impeller from undue abrasions. The modification consists of a water-sealed stuffing box and an adjustable journal box, which do away with loss of priming and enable the journal to be adapted to the wear of the impeller.

R. G. PLUMB, sales manager of the New York office of the Eagle Lock Co., manufacturer of hardware, locks, etc., Terryville, Conn., has been chosen a director of the company at its recent annual meeting. Mr. Plumb succeeds the late Rollin J. Plumb, who was also president of the concern.

CHARLES GLOVER, of the Skinner Chuck Co., manufacturer of chucks, etc., New Britain, Conn., was re-elected a director of the North & Judd Manufacturing Co., New Britain, at the latter company's recent annual meeting.

JAMES F. PULLAN has entered the employ of the Lincoln Machine Co., Pawtucket, R. I., in the capacity of general superintendent.

E. S. MCGONEGAL has been appointed resident sales representative of the Wisconsin Electric Co., manufacturer of Dumore electric tools, Racine, Wis., for the New York and northern New Jersey districts and will make his headquarters at 27 Warren Street, New York City.

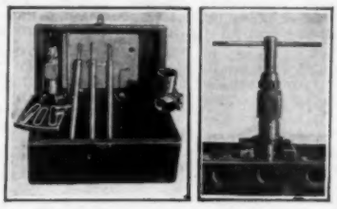
Obituary

Frank Toomey, Sr., founder and for many years president of Frank Toomey, Inc., Philadelphia, Pa., died on Wednesday morning, Aug. 2, at the home of his daughter, in Scranton, Pa., after an illness of approximately three weeks. He was born in Liverpool, England. 72 years ago, of Irish-English parentage, and came to this country when quite a young man. He became connected with the Baxter Engine Co., Hartford, Conn.. and had charge of their exhibit at the centennial exposition at Philadelphia in 1876, subsequently starting, the same year, the

Condensed-Clipping Index of Equipment

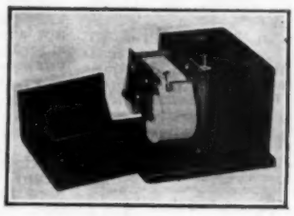
Patented Aug. 20, 1918

Valve Reseating Tool, Boring, "Davis"
Hinckley Machine Works, Hinckley, Ill.
"American Machinist," May 11, 1922



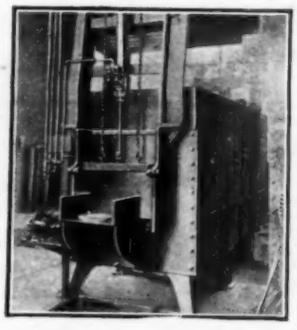
The tool is used on cylinder blocks of automotive engines, as shown at the right. A large bearing above the valve seat holds the cutter bar in place, and is located in a plate or holder clamped to the work. The bar is inserted in the top of the holder and the cutter put in place at the bottom of it. The cutter bar is turned by handle, and feed is provided by a screw. The set includes three boring bars, with $\frac{7}{16}$, $\frac{5}{8}$ and $\frac{7}{16}$-in. pilots, two valve seating cutters, one knurled turning handle, two boring cutters, hexagon setscrew wrench, and an attachment for handling Buick valve cages. Weight, 18 lb. Boxed for export, 25 pounds.

Time-Study Machine
H. H. Williams, 1613 Chestnut St., Philadelphia, Pa.
"American Machinist," May 18, 1922



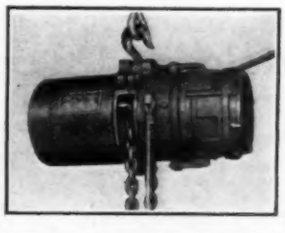
The machine is used in timing machine operations, and makes a permanent record. A strip of paper is moved at a uniform rate of speed by a positive drive regulated to suit conditions. A pen, moved back and forth by two finger keys, traces a line on the moving strip of paper. The graph or record obtained gives all the data for filling in a time-study observation sheet. The length of time between each step can be read on the strip by means of a decimally divided scale. The motor, of spring-driven clock work, is independent of any outside power. Observations of 0.001 min. can be recorded and twenty-four steps or elements are obtainable. The machine is 8 x 8 in. square and $6\frac{1}{2}$ in. high. Weight, $9\frac{1}{4}$ pounds.

Furnace, Hardening, Automatic, Electric, Gleason
American Industrial Furnace Corp., 10 Post Office Square, Boston, Mass.
"American Machinist," May 18, 1922



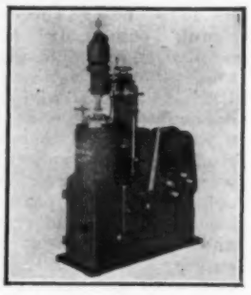
The furnace is used for hardening automobile transmission gears, and is adapted to hardening small and medium-sized parts. The hearth is made up of a series of "thermalloy" rolls geared together and driven by a variable-speed motor. It is designed to operate at temperatures from 1,000 to 1,800 deg. F. There are fourteen changes of speed to the rolls. Hearth: Width, 17 in.; length, 132 in. Electrical capacity, 65 kilowatts. Work capacity, 450 to 700 lb. per hour.

Hoist, Electric, McCollum
Joslyn Manufacturing and Supply Co., 3700 South Morgan St., Chicago, Ill.
"American Machinist," May 25, 1922



The speed-reducing gearing consists of three internal ring gears, three planetary pinions, and a high-speed pinion mounted on the motor shaft. A reduction of speed of from 100: 1 to 350: 1 is obtainable between the driving pinion and the sheave. The action is not reversible, so that the speed-reducing gearing can be operated from the motor end only. Either a.c. or d.c. motors using from 110 to 440 volts can be employed. The hoist is supplied with either rope or chain lift. With the chain lift, a hook can be used on either end. The hoist requires only a small amount of head room.

Grinding Machine, Internal, Vertical, "Bright"
Garvin Machine Co., New York, N. Y.
"American Machinist," May 18, 1922

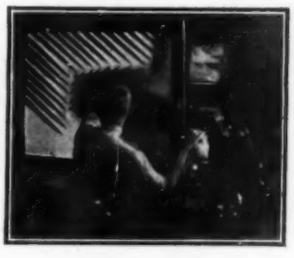


The machine grinds cylindrical holes only. The chief feature is the revolving and reciprocating of the work spindle in one bearing. The wheel spindle is directly driven by a $1\frac{1}{2}$-hp. induction motor at the top at speeds of from 7,500 to 12,000 r.p.m., while the work and feed mechanism are driven by a motor at the rear. A feed screw with a large graduated wheel is carried on the column at the right of the wheel spindle, and feeds the grinding wheel a distance of 0.0001 in. per graduation. The feed is automatically operated. The work-spindle speed of rotation is 100 to 385 r.p.m. in five steps, and the ten reciprocating speeds give from 4 to 48 strokes per minute. Capacity, 4 x 4. Swing, 11 in. Floor space, 20 x 45 in. Height, 63 in. Weight, 1,250 pounds.

Wrench Set, Square and Hexagon, "Bay State"
Allen Manufacturing Co., Hartford, Conn.
"American Machinist," May 18, 1922

The set is expressly for automobile and garage work and comprises a reversible ratchet wrench, universal joint, extension bar, screwdriver and twelve sockets ranging in size from $\frac{7}{16}$ to $1\frac{1}{16}$ in. hexagon, and including $\frac{3}{8}$, $\frac{1}{2}$ and $\frac{5}{8}$ in. square sockets. The set is put up in a hardwood case, and is designated as the No. 19 box set.

Comparator for Gaging Gears, Hartness
Jones & Lamson Machine Co., Springfield, Vt.
"American Machinist," May 25, 1922



A mirror throws the image on the back of a ground-glass screen. Since the chamfered ends of gear teeth do not focus clearly when projected, the instrument is focused at some point along the face of the tooth, while the gear is slightly tilted for the light rays to strike the side of the tooth. Needles, placed in the plane to be explored, give a very sharp projected point and show the outline of the tooth. This outline lies in the image on the screen between the point of the needle itself and the reflection of it in the face of the tooth.

Skid, Lift-Truck, Steel-Frame
Cowan Truck Co., 7 Water St., Holyoke, Mass.
"American Machinist," May 25, 1922

The platform or skid is used with hand-operated lift trucks. The frame of the skid consists of two $2\frac{1}{2}$ x 2 x $\frac{1}{4}$-in. angle irons. Pine planking is secured to the angles by four counter-sunk bolts. The feet of the skid are $1\frac{1}{2}$ in. wide and $\frac{1}{4}$ in. thick and are secured to both the top and the sides of the angle-iron frames. The skids are made in eight lengths from 24 to 80 in., and in nine widths from 24 to 48 in. All sizes can be furnished in heights of $6\frac{1}{2}$, $7\frac{1}{2}$ and $9\frac{1}{2}$ in., and the larger sizes of $11\frac{1}{2}$ in. also. Special sizes and forms of skids can be furnished to suit special requirements.

Clip, paste on 3 x 5-in. cards and file as desired

business which now bears his name. He was instrumental in disposing of several thousand of the Baxter boilers and engines in the eastern part of the United States, and was one of the first to rebuild and guarantee the equipment which he sold. He incorporated the business of Frank Toomey, Inc., in 1909 and retired from the presidency in 1916, being succeeded by his son, Frank Toomey, Jr. Mr. Toomey was a man of remarkable vision and was well and favorably known throughout the United States and Canada for his honorable and square dealings. He had a wonderful memory and could readily recall various types of equipment that were long obsolete, describing same in detail. He was particularly noted for his kindliness and cheerful disposition, and was held in great esteem by his employees and all who came in contact with him during his long and successful business career.

VALENTINE B. CHAMBERLAIN, JR., New Britain, Conn., mill superintendent of the Stanley Works, died suddenly at Oak Bluffs, Mass., August 5, at the age of 36 years.

LAWRENCE A. DANTON, vice-president of the Litchfield Manufacturing Co., Waterloo, Iowa, died at his home in that city, July 31. Mr. Danton was widely known throughout the central western states through his work as general sales manager for the company. He entered the employment of the concern in 1895 and in 1907 moved to Waterloo to become general sales manager. In 1912 he was elected secretary and in 1920, vice-president.

Book Reviews

Metal Cutting Tools. By A. L. De Leeuw. Published by McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York, and 6 and 8 Bouverie St., E. C. 4, London, England. 328, 6 x 9-in. pages, 306 illustrations. Price $3.

The author in an extended experience as engineer in large manufacturing establishments has had abundant opportunities to study the action of cutting tools under varying conditions.

He has used his opportunities both wisely and well, and now gives to the public the results of his observations and experiences through this book, which like many other good books, had its inception in a series of articles written for *American Machinist*.

Perhaps there is nothing in mechanics so little understood as the real action of metal cutting tools, or why some are successful while others fail. Mr. De Leeuw plainly states in his preface that the purpose of the book is to bring before the reader the principles that must be applied in the selection, maintenance and use of metal cutting tools rather than to acquaint him with the multitude of existing tools. That he has more than fulfilled his purpose will be evident to anyone who reads the book.

Beginning with a chapter on the formation of chips, the author leads logically and progressively up to tools of all conceivable types and varieties and thoroughly explains their principles and analyzes their action. Perhaps one of the most valuable features of the book, especially to young engineers, is that in presenting many and varied types of tools, the author thoroughly explains why some are good and some are bad.

Practice based on a study of this book by tool designers and executives in charge of production would undoubtedly show results in increased efficiency. No one in any way responsible for the efficiency of metal cutting tools, either in their design or operation, can afford not to make use of the lessons taught in this book.

The author is to be congratulated on having set before the engineering public, the principles governing the design and efficiency of metal cutting tools in such a clear manner as will enable designers to avoid many pitfalls.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

A merchant in Canada wishes to purchase vinegar pumps. Quotations, f. o. b. port of shipment. Cash to be paid. Reference No. 3088.

A commission merchant in Spain desires to purchase and secure an agency for typewriters, modern office equipment, scales, and machinery in general. Quotations, c.i.f. Gijon or Santander. Correspondence, Spanish. Reference No. 3085.

A merchant in France desires to secure an agency for the sale of weighing machines which will automatically indicate the price of any weight of goods when the price of a unit of the goods is known. Quotations, c.i.f. Dunkirk. Reference No. 3074.

The purchase is desired by a merchant in South Africa of machinery for crushing and refining orthoclase feldspar, which has a potash content of over 10 per cent. Capacity of machinery to be 500 tons monthly. Quotations, f. o. b. New York. Payment, letter of credit in United States. Reference No. 3082.

An engineering firm in Italy desires to secure an agency and purchase electrical machinery (motors, transformers), conductors, compressors, transmission materials, metallic wire lamps at half watt, and electrical appliances in general. Quotations, c. i. f. Leghorn or Genoa. Correspondence, Italian or French. Reference No. 3070.

Pamphlets Received

Power Losses in Automobile Tires. Bureau of Standards publication No. 213, by W. L. Holt, associate mechanical engineer, and P. L. Wormley, physicist of the Bureau. For sale by the Superintendent of Documents, Washington, D. C., price 5 cents.

Testing Materials. American Society of Testing Materials, Philadelphia, Pa. A summary of the proceedings of the twenty-fifth annual meeting of the Society held in Atlantic City, June 27-30, 1922, C. L. Warwick, secretary, 1315 Spruce Street, Philadelphia, Pa.

Crankshafts and Bearings. A treatise on the subject of Crankshafts and Bearings by K. R. Peters. The purpose of the treatise is not to introduce a new process, but to show the most efficient and up-to-date methods of perfect fitting and alignment of bearings and crankshafts. Published by the Peters Engineering Co., 3271 Woodland Ave., Philadelphia, Pa.

Industrial Relations. Proceedings of the Industrial Relations Conference held Oct. 24-27, 1921, at Harrisburg, Pa. The publication contains the complete records of the meetings held during the four days' session, viz., Oct. 24, Boiler Progress and Boiler Uniformity; Oct. 25, Industrial Cooperation, Women and Children in Industry, Stabilizing Industry; Oct. 26, Industrial Education; Oct. 27, Industrial Publicity, Medical Supervision in Industry and Workmen's Compensation. Published by the Commonwealth of Pennsylvania, Department of Labor and Industry, Clifford B. Connelley, Commissioner of Labor.

Trade Catalogs

Pyrometers. The Brown Instrument Co., Philadelphia, Pa. A special illustrated booklet containing a story of temperature control in a large industrial plant with a description of the method used to obtain it.

Hand Vise Lathe. The Campbell Manufacturing Co., Worcester, Mass. A bulletin describing the Ramsdell hand vise lathe, a complete set of tools in a case, consisting of a double-sided combined tool and die holder, feeding device, double end balanced box tool holder, two cutting knives and a set of bushings to take stock from ¼ in. to ½ in. as well as the corresponding S. A. E. dies. The set is especially suited to the needs of the machine owner, garage man or farmer to enable either to make emergency repairs.

Motor Starters. The Westinghouse Electric and Manufacturing Co., Pittsburgh, Pa. A new booklet, Folder 4,500, illustrating and describing the company's line of full-safety motor starters, designed to afford complete protection to the operator and the motor. Four types of starters are featured having capacities ranging from the smallest motor up to 15 hp., 550 volts.

Electric Motors. The Ohio Electric and Controller Co., 5900 Maurice Ave., Cleveland, Ohio. An eight-page bulletin, known as bulletin No. 203, containing detailed descriptions with numerous illustrations, of the company's fractional horse-power alternating and direct current motors, the former product in 110 to 440 volts, 25 to 60 cycles, and the latter, in 32 to 250 volt sizes. The last page of the bulletin contains a complete price list and specifications governing both types manufactured by the company in the various sizes of horsepower.

Steel Windows. The David Lupton's Sons Co., Philadelphia, Pa. A new publication of seventy-two pages, known as catalog No. 110. This new catalog, featuring the steel windows manufactured by the company, shows the excellent skill and arrangement which has marked the other publications of the company. It contains a great variety of illustrations showing not only the construction details of the company's steel window products, but numerous cuts of complete installations. There are also contained many line cuts and considerable data of value to architects and engineers.

Electric Tools. The Black & Decker Manufacturing Co., Baltimore, Md. A new forty-page catalog entitled "P.M.P." the initials signifying products, markets, policies. The catalog is unque in arrangement in that it is a complete merchandising program covering the company's comprehensive line of electric tools published under one cover. The first part of the catalog contains detailed descriptions of each of the many styles of tools with their special features emphasized. A market analysis follows, pointing out the various fields in which the tools are applicable. The publication concludes with an outline of the company's manufacturing and sales policy which is of especial interest to jobbers and dealers, containing as it does, numerous sales and advertising aids. The catalog shows skill in the selection of the many illustrations and in the general preparations of the material and data contained therein.

Forthcoming Meetings

Association of Iron and Steel Electrical Engineers. Annual convention, Sept. 11 to 15 at the new auditorium, Cleveland, Ohio. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa.

American Institute of Mining and Metallurgical Engineers, annual convention, Sept. 25 to 28, 1922, San Francisco, Cal. Secretary, F. F. Sharpless, 29 West 39th Street, New York City.

American Society for Steel Treating. Exposition and convention at the General Motors Co. building, Detroit, Oct. 2 to 7. W. H. Eisenman, 4600 Prospect Ave., Cleveland, is secretary.

American Gear Manufacturers' Association. Fall meeting, Chicago, Ill., Oct. 9, 10 and 11, 1922.

American Manufacturers Export Association annual convention. New York City, Oct. 25 and 26. Secretary, M. B. Dean, 160 Broadway, New York City.

American Trade Association Executives. Third annual meeting, Oct. 25, 26 and 27, 1922, at the Inn, Buck Falls, Pa., (Delaware Water Gap).

National Machine Tool Builders' Association, annual convention. New York City, October, 1922. Secretary, E. F. Du Brul, 817 Provident Bank Building, Cincinnati, Ohio.

National Founders Association. Nov. 22 and 23. Secretary, J. M. Taylor, 29 South La Salle St., Chicago, Ill.

National Exposition of Power and Mechanical Engineering. Dec. 7 to 13, 1922, Grand Central Palace, New York City. Secretary, Calvin W. Rice, 29 West 39th Street, New York City.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

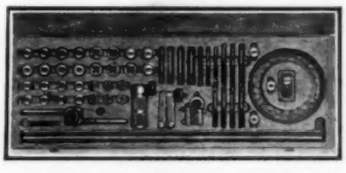
Milling Machine, Vertical, High-Speed, No. 2
Becker Milling Machine Co., Worcester, Mass.
"American Machinist," May 25, 1922

The No. 2 vertical milling and routing machine has been changed to fit it for high-speed work. It is equipped with an auxiliary ball bearing to take the belt pull, so that the machine can be run 50 per cent faster than the standard machine. Two sizes of interchangeable pulleys are provided for the spindle. Another improvement in the machine is the use of a full box-form knee. A steel chip guard is provided in the knee in front of the carriage, to protect the crossfeed screw.

Grinder, Electric, Portable, Model 35
Forbes & Myers, 172 Union St., Worcester, Mass.
"American Machinist," May 25, 1922

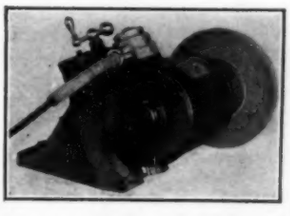
The motor of the device is of the squirrel-cage induction type and has fireproof windings. The insulation is asbestos specially treated to bind the fibers into a mass capable of withstanding a red heat indefinitely. The motor has ¾ hp. and a normal speed of 3,600 r.p.m. The wheel ordinarily carried is 6 x 1 in. in size. In order to prevent the operator from receiving an electric shock from the tool, a grounded wire is employed. The wheel is equipped with a guard and convenient grips are provided for the operator. The switch is within easy reach in the handle.

Vise-Lathe Set, Hand, Ramsdell
Campbell Manufacturing Co., Slater Bldg., Worcester, Mass.
"American Machinist," May 25, 1922



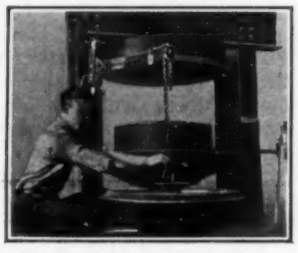
The tool is intended for accurately cutting screws, studs and pins from bar stock without the use of a lathe or screw machine, the work being held in a vise. Wire springs can be wound to any desired pitch. Any combination of bushings, dies and taps in U. S. S. or S. A. E. standard sizes can be furnished. For turning, a different set-up is employed. Bar stock up to and including 1 in. in diameter can be handled. Each set is furnished with a knurling attachment and with centering bushings from ¼ to 1 in. in diameter, by ⅛-in. steps.

Grinding Attachment, Angle-Plate, Motor-Driven, 12-In.
Van Dorn Electric Tool Co., Cleveland, Ohio
"American Machinist," May 25, 1922



The principal feature of the attachment is an inclined slide by which both feed and spindle height adjustment can be obtained by movement in one plane, giving the effect of both horizontal and vertical slides. The rigidity of the machine is greater than that of the vertical slide type. The shaft is 1⅞ in. in diameter through the motor and 1 in. through the wheel. Motors for a.c. or d.c. are interchangeable, and have a normal continuous capacity of 1½ hp., with a peak capacity of 2¼ hp. and a speed of 1,800 r.p.m. Weight, 175 pounds.

Hoist, Wheel, Tire Press, Hand
Reliance Trailer and Truck Co., 1642 Howard St., San Francisco, Cal.
"American Machinist," May 25, 1922



The hoist is used on presses to lift automobile truck wheels into place when changing tires. Two clamps, secured to the upright frame of the press, carry adjustable brackets in which the trunnions of the swinging arm are fastened. Hoisting is accomplished by hand, through a gear reduction connected to the crank at the pivoted end of the device. The wheels are secured by means of cones placed in the hubs. Besides being used on a tire press, the hoist is adaptable to general work around the shop. Different brackets can be furnished for securing it. Capacity, 1,200 pounds.

Reamer, Expansion, "Parob"
Gammons-Holman Co., Manchester, Conn.
"American Machinist," May 25, 1922

The cutting edges of the reamer are alternately parallel and oblique to the axis of the tool. The reamer is expanded from the center by means of a tapered plug, adjusted by a screw in the end. The end of the pilot is recessed to a considerable depth to protect the screw head, and to act as a center for regrinding. Cutting edges on the extreme end of the pilot portion remove the burrs and permit the reamer to enter the hole easily. The reamers are made in one piece, with blades cut from the solid. They are made in standard sizes from ½ to 1½ inches.

Flexible-Shaft Outfit, Motor-Driven, Portable, H-250
Hergi Manufacturing Co., 250 Fifth St., Bridgeport, Conn.
"American Machinist," May 25, 1922

A high-speed motor of ¼ hp. for operation on 110-volt a.c. or d.c. is inclosed in an aluminum casing having a base and handle. A ventilating fan keeps a current of air passing between the field and the armature windings and cools both front and end cap bearings. The flexible shaft is ¼ in. in diameter, 3 ft. long and wound with wire. A ball-bearing handpiece with a ⅛-in. chuck is provided. The No. 4 or 5 shaft, sheath and handpiece are interchangeable on the motor unit. Six feet of drop cord with an attachment plug are provided with each motor.

Lapping Tool, Internal
Stimson Engineering Co., 598 Sixty-Eighth Ave., Milwaukee, Wis.
"American Machinist," May 25, 1922

The device is used for lapping the bores of automotive cylinders. The shoes which make the contact with the cylinder bore are held by flexible connections at one end of the shaft, and can be easily removed. Two sets are provided to fit bores 2⅞ to 3⅛ in. in diameter, and 3⅛ to 4¼ in., respectively. A nut operating the taper adjustment serves to fit the shoes to the cylinder. The disk mounted on the shaft is adjustable in position, acting as a stop and preventing the tool from feeding too deeply into the cylinder. The tool can be operated by an electric or air-driven portable drill or by a drilling machine, or it can be attached to a lathe tailstock. The tool requires no lining up with the cylinder.

Clip, paste on 3 x 5-in. cards and file as desired

The Weekly Price Guide

Rise and Fall of the Market

Advances—Price of steel shapes, plates and bars, f.o.b. Pittsburgh, nearing minimum of $1.80 per 100 lb. Quotation of $1.70 fast disappearing, except on orders for shipment during last quarter. Sustained demand, however, giving rise to quotations of $2 per 100 lb. on plates in small tonnages, for early shipment. Recent rise in mill price of bolts, nuts and rivets, reflected in reduction of about five points in warehouse discounts in Cleveland and New York.

Lead quoted at 6.70c. as against 6c. per lb. in New York warehouses. Copper sales heavier than year ago; prices firm. Linseed oil up 2c. per gal. (5 bbl. lots) in New York.

Declines—Tin quoted at 32¾c. as compared with 32¾c. per lb. last week, in New York warehouses. Zinc market easier; lower prices in St. Louis.

IRON AND STEEL

PIG IRON—Per gross ton—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$24.56
Northern Basic	27.27
Southern Ohio No. 2	27.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	30.66
BIRMINGHAM	
No. 2 Foundry	20.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	29.76
Virginia No. 2	30.17
Basic	27.25
Grey Forge	27.25
CHICAGO	
No. 2 Foundry local	24.50
No. 2 Foundry, Southern (silicon 2.25@2.75)	26.00
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	25.00
Basic	25.00
Bessemer	25.00

IRON MACHINERY CASTINGS—In cents per pound:

	Light	Medium	Heavy
Cincinnati	15.0	10.0	4.75
Detroit	10@12	8.0	3@4
New York	9@10	6.0	4.0
Cleveland	8.75	6.5	4.5
Chicago	5.0	4.5	3.5

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.40@2.60	3.78	3.50	3.75
No. 12	2.45@2.65	3.83	3.55	3.80
No. 14	2.50@2.70	3.88	3.60	3.85
No. 16	2.70@2.90	3.98	3.70	3.95
Black				
Nos. 17 and 21.	3.00@3.25	4.15	3.80	4.30
Nos. 22 and 24.	3.05@3.30	4.20	3.85	4.30
Nos. 25 and 26.	3.10@3.35	4.25	3.90	4.35
No. 28	3.15@3.40	4.35	4.00	4.45

Galvanized	Pittsburgh	New York	Cleveland	Chicago
Nos. 10 and 11.	3.15@3.35	4.35	3.85	4.45
Nos. 12 and 14.	3.25@3.50	4.45	3.95	4.55
Nos. 17 and 21.	3.55@3.80	4.75	4.25	4.85
Nos. 22 and 24.	3.70@3.95	4.90	4.55	5.00
No. 26	3.85@4.10	5.05	4.70	5.15
No. 28	4.15@4.40	5.35	5.00	5.45

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
		BUTT WELD			
1 to 3	71	58½	¼ to 1¼	44½	29½
		LAP WELD			
2	64	51½	2	39½	25½
2½ to 6	68	55½	2½ to 4	42½	29½
7 to 8	65	51½	4½ to 6	42½	29½
9 to 12	64	50½	7 to 12	40½	27½
		BUTT WELD, EXTRA STRONG, PLAIN ENDS			
1 to 1½	69	57½	¼ to 1½	44½	30½
2 to 3	70	58½			
		LAP WELD, EXTRA STRONG, PLAIN ENDS			
2	62	50½	2	40½	27½
2½ to 4	66	54½	2½ to 4	43½	31½
4½ to 6	65	53½	4½ to 6	42½	30½
7 to 8	61	47½	7 to 8	35½	23½
9 to 12	55	41½	9 to 12	30½	18½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	66%	53%	60½%	47½%	62½%	48½%
2½ to 6 in. steel lap welded	61%	47%	58½%	44½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 10%. Cast iron, standard sizes, 32–5% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.00	6.00	4.50
Spring steel (light) (base)	6.00	6.00	6.00
Coppered Bessemer rods (base)	6.03	8.00	6.85
Hoop steel	3.78	3.50	3.48
Cold rolled strip steel	6.50	8.25	6.15
Floor plates	4.80	4.91	5.08
Cold finished shafting or screw	3.50	3.30	3.40
Cold finished flats, squares	4.00	3.80	3.90
Structural shapes (base)	2.83	2.66	2.70
Soft steel bars (base)	2.73	2.56	2.60
Soft steel bar shapes (base)	2.73	2.56	2.60
Soft steel bands (base)	3.38	3.06	3.35
Tank plates (base)	2.83	2.66	2.38
Bar iron (2.25 at mill)	2.70	2.21	2.28
Drill rod (from list)	55@60%	55%	50%
Electric welding wire:			
5/32	8.00		12@13
¼	6.50		11@12
5/32 to ¼	6.25		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			14.62½
Tin, 5-ton lots, New York			32.50
Lead (up to carlots), St. Louis	5.52½; New York		6.10
Zinc (up to carlots), St. Louis	6.30 ; New York.		7.00
Aluminum, 98 to 99% ingots, 1-15 ton lots	New York 19.20	Cleveland 20.00	Chicago 18.00
Antimony (Chinese), ton spot	5.50	7.50	6.25
Copper sheets, base	21.00	21.50@21.75	23.00
Copper wire (carlots)	16.50	17.50	16.25
Copper bars (ton lots)	19.50	22.50	19.50
Copper tubing (100-lb. lots)	23.75	24.50	23.00
Brass sheets (100-lb. lots)	17.75	19.50	18.75
Brass tubing (100-lb. lots)	21.50	22.50	20.50

—Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Brass rods (1,000-lb. lots)	16.25	17.50	15.75
Brass wire (carlots)	18.25	19.50	.....
Zinc sheets (casks)	8.50	9.00	.....
Solder (½ and ½), (caselots)	23.00	23.50	20.00
Babbitt metal (fair grade)	24.50	42.00	36.00
Babbitt metal (commercial)	11.12½	16.00	9.00
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J .	39.00	.....	....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N.J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.00	12.00	12.00
Copper, heavy, and wire	11.75	11.00	11.25
Copper, light, and bottoms	9.75	9.50	10.25
Lead, heavy	4.75	4.50	4.50
Lead, tea	4.25	3.50	3.50
Brass, heavy	7.00	6.00	9.00
Brass, light	6.00	5.00	6 25
No. 1 yellow brass turnings	6.50	6.00	6.75
Zinc	3.00	3.25	3.50

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

		New York	Cleveland	Chicago
"AAA" Charcoal Melyn Grade:				
IC,	20x28, 112 sheets	20.00	18.25	18.50
IX,	20x28, 112 sheets	23.00	21.00	20.90
"A" Charcoal Allaways Grade:				
IC,	20x28, 112 sheets	17.00	16.00	17.00
IX,	20x28, 112 sheets	20.00	18.75	19.60
Coke Plates, Bright				
Prime, 20x28 in.:				
100-lb.,	112 sheets	12.50	11.00	14.50
IC,	112 sheets	12.80	11.40	14.80
Terne Plate				
Small lots, 8-lb. Coating:				
100-lb.,	14x20	7.00	5.60	7.25
IC,	14x20	7.25	5.85	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.07½@$0.10	$0.12	$0.11¼
Cotton waste, mixed, per lb.	.055@.09	.09	.08
Wiping cloths, 13¼x13¼, per lb.	.075	.10	.10
Wiping cloths, 13¼x20½, per lb.	.08	.11	.13
Sal soda, 100 lb. lots	2.80	2.40	2.65
Roll sulphur, 360 lb. bbl., per 100 lb	2.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots.	.91	1.17	1.01
White lead, dry or in oil	100 lb. kegs.	New York,	12.50
Red lead, dry	100 lb. kegs.	New York,	12.50
Red lead, in oil	100 lb. kegs.	New York,	14.00
Fire clay, per 100 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville	per net ton	13.50@14.00	
Coke, prompt foundry, Connellsville	per net ton	15.00@15.50	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	45%	60%	60%
1½ and 1¼x3 in. up to 12 in.	25%	65%	60-10%
With cold punched sq. nuts	30%	.....	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	35%	.....	$4.00 off
Button head bolts, with hex. nuts	20%	$3.90 net	.....
Hex. head and hex. nut bolts	25%	.....	65-5%
Lag screws, coach screws	45%	.....	60-5%
Square and hex. head cap screws	75%	70%	70-10%
Carriage bolts, up to 1 in. x 30 in.	35%	50-10-5%	50-5%
Bolt ends, with hot pressed nuts	45%	.....	55%
Tap bolts, hex. head, list plus	10%	.....	.....
Semi-finished nuts ⅝ and larger	65%	70-10%	80%
Case-hardened nuts	50%	.....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$5.00	$3.50	$3.50
Washers, cast iron, ⅜ in. per 100 lb. (net)	4.00	3.50	3.50
Washers, round plate, per 100 lb. Off list	3.00	5.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	1.50	3.50	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	1.50	3.50	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.50	3.50	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.50	3.50	4.00
Rivets:			
Rivets, 7/16 in. dia. and smaller	55%	65%	60-10%
Rivets, tinned	55%	65%	4½c. net
Button heads ⅜-in., ½-in., 1x2 in. to 5 in., per 100 lb. (net)	$4.50	$3.50	$3.25
Cone heads, ditto (net)	4.60	3.60	3.35
1½ to 1¾-in. long, all diameters, *EXTRA* per 100 lb	0.25	.....	0.15
⅝ in. diameter *EXTRA*	0.15	.....	0.15
½ in. diameter *EXTRA*	0.50	.....	0.50
1 in. long, and shorter *EXTRA*	0.50	.....	0.50
Longer than 5 in. *EXTRA*	0.25	.....	0.25
Less than 200 lb *EXTRA*	0.50	.....	0.50
Countersunk heads *EXTRA*	0.35	.....	$3.35 base
Copper rivets	55-5%	50%	50-%
Copper burs	35%	50%	20%

Lard cutting oil (50 gal. bbl.) per gal.	$0.55	$0.50	$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.33	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin. ft., $2.88:			
Medium grade	40-5%	40-10-2½%	50%
Heavy grade	30-5%	40%	40-5%
Rubber and duck:			
First grade	60-5%	50-10%	40-10%
Second grade	60-10-5%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets, Flint paper	$5.84	$3.85	$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	32.75	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll,	4.50	.....	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	1.32	.....	1.40
Cloth	3.02	.....	3.20

New and Enlarged Shops

Machine Tools Wanted

Conn., Norwalk—Commerce Street Garage, Commerce St., A. Erickson, Purch. Agt.—one lathe and tool grinder for automobile repair work.

Conn., South Norwalk—Schaub & Byrne, 18 Washington St.—one lathe for garage work (used).

Ill., Chicago—J. L. Mott Iron Wks., 1010 North Clark St., A. D. Erickson, Purch. Agt.—lathe, drill press, belting, shafting, hangers, bearings, tub hammer, pulleys, and cutting off power machine.

Ill., Chicago—B. J. Stephens, 28 North Clinton St.—power punch press.

Kan., Sedgwick—The Sedgwick Alfalfa Mills, J. S. Congdon, Purch. Agt.—power lathe.

Kan., Wichita—Bunker Auto Co., South Topeka Ave.—electric portable steel drill.

Kan., Wichita—Philadelphia Battery Co., (Electrical Dept.) 1st and Topeka Sts., A. Center, Purch. Agt.—power lathe.

Kan., Wichita — White Truck Co., 217 West Lewis St., J. F. Kremel, Purch. Agt.—power drill press, lathe, emery wheel and stand, shafting, belting, hangers, bearings and pulleys.

Md., Frederick—G. W. Sheeley Co.—small punching machine to stamp light cold punch work.

Mich., Grand Rapids—Wolverine Metal Specialties Co.—machine shop equipment.

Minn., Minneapolis — Minneapolis Metal Products Co., 16th Ave. S. E. and 8th St.—machine tools for sheet metal work, including shears, punches, and one electric spot welder.

N. Y., Buffalo—Allen Mfg. & Welding Corp., 726 Washington St.—electric floor base grinder, also electric portable grinder.

N. Y., Buffalo—D. Liberty, 167 Bway.—machinery, tools and equipment for proposed $28,000 garage.

N. Y., Long Island City—Wappler Electric Co., 162 Harris Ave., A. Verhoef, Purch. Agt.—one No. 2 surface grinder (Brown and Sharpe).

N. Y., New York City—H. Medalie, 460 East 164th St.—equipment for machine shop.

N. D., Minot—B. Johnson—heavy machine shop equipment.

Pa., Farrel—Bd. of Educ.—variety saw, grinder, lathes, bench tools, and woodworking machinery.

Pa., Pittsburgh—The Blaw-Knox Co., Freeport Rd.—sheet metal squaring shears.

Pa., Rochester — M. R. Regan — pipe thread protectors.

Pa., Scranton—C. W. Drolsback, 1208-1214 Wyoming Ave.—complete mechanical equipment and tools for large gas and service station now under construction.

Pa., Scranton—Glen Alden Coal Co., 306 Jefferson Ave.—equipment for proposed 1 story machine shop near Wilkes-Barre.

Pa., Sharpesville — W. L. Craig, 12th Ave.—equipment and machinery for proposed machine shop.

Pa., Wilkensburg (Pittsburgh P. O.)—Universal Machine & Mfg. Co., 407 Rebecca Ave., G. P. Rhodes., Pres.—drill press, forge, and welding outfit.

Pa., Williamsport—Imperial Band Instrument Mfg. Co., c/o C. W. Mink, Attorney—machinery for the manufacture of band instruments.

Va., Richmond—Acme Auto Service Co., 907 Hull St.—drill press.

Va., Richmond—W. T. Gray Co., 511 West Clay St.—lathe and drill for automobile repair shop.

Va., Richmond—Hearn Motor Co., 1101 Hull St.—drill, lathe, and burning in machine.

W. Va., Clarksburg—Pittsburgh & West Virginia Gas Co.—machinery for machine shop, garage and repair shop.

Wis., Madison—Madison Garage & Machine Co., 18-24 North Charter St., C. L. Lodine, Mgr.—machinery and equipment for auto repair and machine shop.

Wis., Madison—A. Maisano, 821 Regent St.—machinery for proposed auto repair shop, including a 1-ton press.

Wis., Milwaukee—Diamond Motor Service, c/o L. F. Miller, 714 Holton St.—auto repair machinery including drill press, air tank and pump.

Wis., Milwaukee—P. Portman, 3212 Burleigh St. (auto repair shop)—grinder, lathe, drill press, air tank and pump.

Wis., Waukesha—P. Wolf, 220 Main St., (auto repair station)—drill press and small tools.

India, Bombay—Valabhdas Runchordas & Co., 70 Appollo St.—lathes, milling machines, shapers, drills, tools for small shop work, machinery for the manufacture of tin gramophone horns, tin toys, gramophone records, gramophone and sewing needles and needle boxes; machinery for cutting mica from 1 to 3 in. in diameter; woodworking machinery for the manufacture of gramophone-cabinets; spraying machinery for painting gramophone horns and toys; printing machinery. Catalogue with full particulars and lowest export prices, also samples of gramophone needles, springs and cabinet fittings of all kinds, required in the manufacture of cabinets.

Machinery Wanted

Conn., Bridgeport—McCathron Boiler Wks. Co., 72 Knowlton St.—air compressor, capacity 80 cu.ft. per minute.

Ga., Atlanta—W. H. Bradley, 219 Grant Bldg.—one 20-ton narrow gauge saddle tank locomotive.

Ill., Altona—The Record—one 25 in. power paper cutter.

Ill., Charleston—The News—one 30 point headletter mold, 13 ems.

Ill., Chicago—Chicago Book Bindery, 500 South State St.—one 14 x 22 printing press for power equipment.

Ill., Chicago—Wanner Mchy. Co., 716 South Dearborn St.—power folding machine, large and small power paper cutter, also power stitcher.

Ind., Fort Wayne—Fort Wayne Oil & Supply Co., 225-229 East Columbia St.—one 6 to 12 in. motor driven pipe machine.

Ind., Goshen—News Printing Co.—linotype machine, model No. 5.

Kan., Wichita—M. R. Amerman, (general contractor) 248 North Market St.—paving mixer.

Kan., Wichita—The Fibre Mfg. Corp., Room 612, New Orpheim Bldg., C. T. Banon, Pres.—wood and fibre working machinery, shafting, hangers, bearings, pulleys, belting, sawing, cutting off.

Kan., Wichita—J. K. Gano, 252 South Chautauqua Ave.—power printing press.

Kan., Wichita—Lumber & Supply Co., Murdock Bldg., A. Gilkinson, Purch. Agt.—power planer.

Kan., Wichita—J. A. McMaster, 1352 South Water St.—job printing press for power equipment.

Kan., Wichita—G. Miller, 742 Hendricks St.—large job printing press and power. lathe.

La., Baton Rouge—Bd. of Educ., R. C. Gordon, Pres.—woodworking and ironworking machinery and equipment for new school.

Mass., Palmer—The Journal—one 16 x 31 in. press for power equipment.

Mich., Williamston—C. King—one 4 page, 7 column news and job presses, and folder for power equipment.

Minn., Minneapolis — Washington-Crosby Co., (flour manufacturers)—mechanical equipment for proposed 4 story warehouse at Blackwell Canal, Buffalo, N. Y.

Mo., Kansas City—Bd. of Educ.—equipment for boys manual training shop, also floor scarifier.

Mo., Kansas City—Davis Truck Co.—one truck, 3 to 5 ton.

N. Y., Amsterdam — Fitzgerald Bros., manufacturers of hosiery—thread cutter (floating type), also style 60 U. D. Merrow sewing machine.

N. Y., Auburn—Auburn Converting Co., Inc., 185 Clar St., S. Tabor, Dir.—machinery and equipment for the manufacture of twine and twine products.

N. Y., Auburn—W. J. Henry—complete machinery and equipment for proposed $100,000 tool plant on York St.

N. Y., Brooklyn—Clifton Knitting Mills, 134 Stanhope St.—16 in. Brinton circular machines.

N. Y., Geneva—Supply Sales Corp., F. Dwyer, Pres.—machinery for the manufacture of cloth and wood specialties.

N. Y., Lockport—Lockport Fdry. Corp., R. E. Bryant, Treas.—foundry and machine shop equipment for proposed extension to plant, also iron working machinery.

N. Y., Odessa—H. Couch—equipment for development of salt deposits, here.

N. Y., Rochester—C. C. Hall, Inc., 347 Blossom Rd., (packers of fruit and apples)—packing machinery, also equipment for large forge plant.

N. Y., Rochester—Rochester Telephone Corp., 59 Stone St.—equipment for proposed building on St. Paul St., to include service and repair departments, garage, stockrooms and cabinet shop.

N. Y., Rochester—Sill Stove Wks., Inc., Oak St.—machinery and equipment for proposed foundry cleaning plant at 524 Oak St.

O., Delaware—Climax Rubber Co., T. Waddell, Purch. Agt.—2 vulcanizers, and other tube making machinery.

O., Mansfield—Pederson Machine Co.—machinery for the manufacture of umbrellas.

O., Newton Falls—Newton Falls Herald, A. Todd, Jr., Purch. Agt.—linotype and stereotyping outfit.

O., Portsmouth — Portsmouth Stove & Range Co., Gallia and Campbell Sts.—machinery and equipment for proposed addition to factory.

O., Toledo—The Milburn Wagon Co.—one 5 ft. steel power brake, to handle up to 16 in. gage metal.

Okla., Bartlesville—Phillips Petroleum Co.—machinery and equipment for proposed gasoline absorption plant.

Okla., May—The May Bugle, A. Latta, Purch. Agt.—newspaper power and job press.

Okla., Orlando—E. Davis—leather working and polishing machinery, shafting, hangers, bearings, and pulleys.

Pa., Carrick (Pittsburgh P. O.)—Bd. of Educ., G. L. Suttler, 2417 Brownsville Rd., Pres.—equipment for vocational department of proposed new school.

Pa., Easton—Uhl's Brewing Co., G. F. Coffin, Solicitor—machinery for manufacturing bottling and preparing beverages.

Pa., Freedom—Freedom Oil Works—machinery and equipment for proposed 2 story addition to garage and repair shop.

Pa., Glen Olden—A. K. Sonnekalb (machine shop and trunk factory)—3 riveting machines for power equipment.

Pa., Grove City—McKay Carriage Wks., Erie St.—equipment for addition to shop, will manufacture automobile bodies.

Pa., Patton—Bd. of Educ., F. L. Brown, Secy.—equipment for manual training department of new high school.

Pa., Pittsburgh—Pittsbugh Railways Co., 6th Ave.—one locomotive crane.

Pa., Pittsburgh—United Engineering & F'dry. Co., Farmers Bank Bldg.—one 40 ton and two 10 ton mill type cranes for National Enameling & Stamping Co., St. Louis, Mo.

Pa., Pittsburgh—U. S. Drug & Chemical Co.—equipment for proposed drug and chemical plant.

Pa., Sharon—Bd. of Educ., W. Whitehead, Secy.—equipment for manual training department of proposed high school.

Pa., Sharon—Ebblie & Hunter, 64 Vine St.—one machine paper baler.

Pa., Sharon—Z. N. Mason, 691 South Irvine St.—U. S. Hoffman pressing machine; medium size electric finisher; machinery and equipment for electric shoe repair.

Pa., Warren—P. V. Edgett, 49 Clark St.—one mortising machine. (new or used).

Pa., Waynesboro—The Frick Co., (manufacturer of refrigerating plants and ice machines)—two 5-ton, one 10-ton, and six 25-ton cranes.

Pa., Wrightsville—H. K. Smith—machinery and equipment for the manufacture of thermometers and like instruments.

Tenn., Memphis—Memphis Sash & Door Co., 673 South Dudley St.—complete equipment and machinery for proposed sash and door factory, including jointers, planers, jigs, etc., on R.R. St. and Roland Ave.

Tex., Beaumont—Stedman Fruit Co.—refrigeration machinery and equipment for $180,000 refrigerator plant.

Tex., Cleburne—Home Steam Laundry, 416 East Wardville St.—boiler feed pump.

Tex., Dallas—Brown Garage—4612 Main St.—band saw for power equipment.

Tex., Sherman—Hunter Printing Co.—one 7 column quarto folder, and set of 8 point mats.

Va., Richmond—S. W. Hatton, 905 Hull St. (batteries)—rectifier.

Wash., Brewster—D. L. Gillespie, Proprietor of Brewster Herald—presses and linotype machine.

W. Va., Clarksburg—Clarksburg Ice & Storage Co.—machinery and equipment for proposed ice storage plant, capacity 4,500 ton.

W. Va., Clarksburg—Hornor Bros.—equipment and machinery for proposed $30,000 ice cream plant at Shinnston, W. Va.

W. Va., Weirton—Weirton Steel Co.—one ladle crane.

Wis., Cudahy—J. Bersic, Layton Ave. and Kingan St.—machinery for sheet metal working.

Wis., Green Bay—The Bd. of Educ., I. H. McIntyre, City Hall, Supt.—equipment and machinery for proposed manual training building.

Wis., Milwaukee—Ever-Glow Light Co., 776 Tentonia Ave., J. Geissman, Purch. Agt.—special machinery for the manufacture of metal lighting fixtures, belting, and shafting.

Wis., Milwaukee—H. E. Krueger, 1040 Holton St.—equipment for mechanical bake shop, and electric motors.

Wis., Milwaukee—Midwest Die Casting Co., c/o E. A. Rathgen, 1211½ National Ave. (rear)—die casting machinery.

Wis., Milwaukee—Milwaukee Steam Appliance Co., c/o L. E. Ficheurx, 120 Wisconsin St.—special machinery for the manufacture of oil pumps, gauges, etc., also shafting and belting.

Wis., Milwaukee—Western Newspaper Union, 286 Milwaukee St.—auto press.

Wis., Platteville—E. H. Johnson—woodworking machinery for proposed toy factory.

Wis., Racine—Horlick Malted Milk Co., Horlicksville—special machinery for proposed manufacturing plant.

Wis., Wausau—Tractor & Truck Improvement Co., c/o D. Healy, 506½ 3rd St.—machinery for the manufacture of tractor drives and transmissions.

Wyo., Casper—Lukis Candy Co., C. C. Lukis, Pres.—machinery and equipment for large candy manufacturing plant.

Ont., Ganonoque—Ontario Steel Products Co., Ltd.—$60,000 worth of machinery for steel plant.

Ont., Niagara Falls—Dominion Insulator Co.—machinery and equipment for proposed insulator factory.

Ont., St. Thomas — St. Thomas Metal Signs, Ltd.—Hoe front delivery, stop cylinder printing press No. 9½, to take sheet metal 36 x 60 in.

Ont., Sarnia—Brutons Pure Food Bakery—complete modern machinery and equipment for 2 story, 65 x 150 ft. bakery and confectionery building.

Ont., Thamesville—B. E. Wallace—prices on saw mill equipment and machinery to replace that destroyed by fire.

Ont., Toronto—Toronto Transportation Comn., Yonge and Front Sts.—equipment for proposed car barns and repair shops.

Ont., Wallaceburg—Dominion Glass Co., Ldt.,—cable conveyors for handling 33 x 10 in. pallets from machine to drying racks.

Ont., Wallaceburg—Sydenham Brick & Tile Co., E. Morse, Genl. Mgr.—equipment for addition to brick and tile plant.

Que., Acton Vale Town—J. S. St. Pierre, Secy.-Treas.—supply of mechanical gravity filters and equipment for pumping station.

Que., Montreal—Talpis & Kert, (metal merchants) 125 Nazareth St.—complete laboratory equipment to replace that which was destroyed by fire. (between $2,000 and $3,000).

Metal Working Shops

Ariz., Superior—Magma Copper Co. plans to build a large smelting plant here. Estimated cost $500,000. Architect not announced.

Cal., Los Angeles—Union Pacific Ry., 610 South Main St., plans to build shops and classifications yards and make other improvements on a 516 acre site adjoining southern boundary of city. Estimated cost $29,000,000. Work will be supervised from local offices. Private plans.

Cal., San Francisco—H. Baumann, Archt., 251 Kearny St., is receiving bids for the construction of a 1 story garage and battery service station on 4th Ave. and Geary St., for J. Weissbein, c/o architect. Estimated cost $12,000.

Ill., Chicago—S. Malty, c/o Dubin & Eisenberg, Archts., 19 West Washington St., has awarded the contract for the construction of a 1 story, 125 x 200 ft. garage on Taylor St. and Independence Blvd. Estimated cost $60,000.

Mich., Battle Creek—Rich Steel Products Co., Springfield Pl., plans to build a 3 or 4 story factory. Estimated cost $500,000. Will not mature before 1923. Architect not selected.

Minn., Duluth—M. O. Anderson, 1930 East 4th St., will build a 1 story, 100 x 140 ft. garage on Superior St. and 14th Ave. E. Estimated cost $75,000.

Minn., Minneapolis—The City, c/o W. R. Young, registrar, Water Dept., City Hall, plans to build a 2 story warehouse, shops, garage and offices, on 5th St. and East Hennepin Ave. Estimated cost $60,000. Architect not selected.

Minn., Minneapolis—The Dayton Co., 7th St. and Nicollet Ave., has awarded the contract for the construction of a 2 story, 100 x 143 ft. garage on 11th St. and 1st Ave., N. Estimated cost $61,000.

Minn., Minneapolis—Payne Motor Co., 1301 Hennepin Ave., has awarded the contract for the construction of a 3 story, 100 x 150 ft. garage and sales building on 14th St. and Harmon Pl. Estimated cost $117,098.

N. H., Manchester — F. P. Carpenter, Mechanic St., had plans prepared for the construction of a 1 story garage, service station and repair shop. Estimated cost $50,000. W. H. Rhodes, 574 Congress St., Portland, Me., Archt.

N. Y., Auburn—W. J. Henry and others, 128 South St., plan to build a large tool factory on York St. Estimated cost $100,000. Engineer not announced.

N. Y., Rochester—Gallagher Motor Co., Inc., has awarded the contract for the construction of a 72 x 159 ft garage and service station, 32 ft. high, on Monroe Ave. Estimated cost $50,000. Noted July 20.

N. Y., Rochester—Rochester Telephone Corp., 59 Stone St., is having plans prepared for the construction of a 2 story, 145 x 200 ft. building on St. Paul St., to include service and repair departments, garage, stockrooms and cabinet shop. Estimated cost $130,000. J. F. Warner, c/o owner, Archt.

O., Cleveland—A. W. Henn and J. L. Free, 1004 Prospect Ave., have awarded the contract for the construction of a 1 story, 100 x 200 ft. commercial building and garage at 3746 Prospect Ave. Estimated cost $75,000. Private plans.

O., Columbus—Lawwell-Leish Co., 97 North 4th St., is having plans prepared for the construction of a 2 story, 32 x 187 ft. garage and service station. Estimated cost $40,000. Private plans.

O., Lima—Lima Locomotive Wks., South Main St., has awarded the contract for the construction of additions to its plant, including 5 buildings. Estimated cost $1,500,000.

O., Portsmouth—Portsmouth Stove & Range Co., Gallia and Campbell Sts., has awarded the contract for the construction of a 5 story addition to its stove factory. Estimated cost $75,000. Architect not announced.

O., Portsmouth — Universal Motor Co., 9th and Chillicothe St., has awarded the contract for the construction of a 2 story, 130 x 296 ft. garage. Estimated cost $80,000.

Pa., Carbondale—S. D. Chandler, 82 Main St., plans to build a 3 story garage and salesroom, on South Main St. Estimated cost $40,000. Architect not announced.

Pa., New Castle—American Sheet & Tin Plate Co., Frick Bldg., Pittsburgh, plans to build a tin mill unit at its Shenango Wks., here. Estimated cost $5,000. Architect not announced.

Pa., Oil City—National Transit Pump and Machine Co. plans to build a 1 story, 80 x 200 ft. foundry. Private plans.

Pa., Osgood (Greenville P. O.)—De Roth Steel Truck & Car Wheel Co., 611 Keystone Bldg., Pittsburgh, has awarded the contract for the construction of a 1 story, 100 x 200 ft. manufacturing plant here. Noted Aug. 3.

Pa., Pittsburgh—J. P. Koehler & Co., 2735 Liberty Ave., has awarded the contract for the construction of a 1 story metal factory. Estimated cost $18,000.

Pa., Pittsburgh—Standard Underground Cable Co., 16th and Pike Sts., has awarded the contract for altering its manufacturing plant. Estimated cost $20,000.

Pa., Starbrick (Warren P. O.)—Warren Steel Car Co., plans to build a 1 story, 90 x 260 ft. factory. Estimated cost $75,000. Private plans.

W. Va., Clarksburg—Pittsburgh & West Virginia Gas Co., plans to remodel present buildings and build a small addition, to include complete machine shop, garage and repair shop. Estimated cost $9,000. Architect not announced.

Wis., Chippewa Falls—F. A. Bigler, 14 East Central St., is having plans prepared for the construction of a 2 story, 124 x 130 ft. garage on Grand Ave. Estimated cost $75,000. E. J. Hancock, Laycock Bldg., Eau Claire, Archt.

Wis., Madison—A. Maisano 821 Regent St., has awarded the contract for the construction of a 2 story, 50 x 90 ft. garage and repair shop. Estimated cost $40,000.

Wis., Racine—Belle City Malleable Iron Co., Kewaunee St., has awarded the contract for the construction of a 1 and 2 story, 80 x 100 ft. factory and office building. Estimated cost $65,000.

Ont., Leaside—Durant Motor Co. of Canada, Royal Bank Bldg., Toronto, has awarded the contract for the construction of a 1 story, 40 x 100 ft., 3 story, 80 x 401 ft., a 3 story 100 x 401 ft., a 1 story, 20 x 200 ft. and a 1 story 130 x 500 ft. auto factory, here. Estimated cost $750,000. Private plans.

Ont., Saulte Ste. Marie—Algoma Steel Corp., 503 Queen St. E., plans to build a 1 story heat treatment plant. Estimated cost $50,000. Private plans.

Ont., Toronto—James, Proctor & Redfern, Engrs., 36 Toronto St., are receiving bids for the construction of a 2 story garage, show room and auto parking station, for the Court St. Auto Parking Service Co., Ltd., 14 Court St. Estimated cost $100,000.

General Manufacturing

Ala., Magazine—Alabama Saw Mills plans to rebuild portion of plant destroyed by fire. Estimated cost $50,000. Architect not announced.

Cal., Burlingame—Dairy Delivery Co., 3350 19th St., San Francisco, is having plans prepared for the construction of a 1 story dairy on San Matteo and Howard Aves., here. Estimated cost $20,000. W. H. Toepke, 942 Market St., San Francisco, Archt.

Cal., Santa Clara—Wolfe & Higgins, Archts., Auzerais lBdg., San Jose, are receiving bids for the construction of a 1 story newspaper plant here for the Santa Clara News.

Cal., Turlock—Hunt-Jewett-Bontz Co., (California Sweet Potato Corp.) has awarded the contract for the construction of a 1 story alcohol and vinegar plant on South 1st St. Estimated cost $180,000.

Conn., Danbury—The Mallory Hat Co. has awarded the contract for the construction of a 6 story, 40 x 60 ft., and a 3 story, 60 x 160 ft. manufacturing building. Estimated cost $100,000.

Conn., Manchester—The Orford Soap Co., Hillard St., has awarded the contract for the construction of a large addition to its plant. Noted July 6.

Conn., New London—New England Carpet & Lining Co., Water and John Sts., has awarded the contract for the construction of a 1 story, 48 x 100 ft. factory addition. Estimated cost $20,000.

Fla., Tampa—The White Star Laundry, Inc., 204 Cass St., has awarded the contract for the construction of a 2 story, 105 x 172 ft. steam laundry. Estimated cost $200,000. H. T. Richards, Pres.-Secy.-Mgr.

Ill., Chicago—Chicago Butchers Calf Skin Assn., Inc., 205 Milwaukee Ave., had plans prepared for the construction of a 3 story, 24 x 140 ft. fertilizer plant at 3208 South Robey St. Estimated cost $50,000. H. C. Christensen, 7258 Union Ave., Archt.

Ill., Chicago—McAdam Mfg. Co. has awarded the contract for the construction of a 2 story factory, for the manufacture of paints, on 27th and Troy Sts. Estimated cost $100,000.

Ind., Frankfort—R. W. Voorhees plans to build a 1 story, 44 x 140 ft. lumber plant and mill. Estimated cost $30,000. Architect not selected.

La., Price (Isabel P. O.)—The Foster Canning Co., Biloxi, Miss., plans to build a canning plant, for shrimp and oysters, here. Estimated cost $30,000.

Mass., Palmers—M. J. Whittall and associates, Brussels St., Worcester, will build a 2 story, 70 x 210 ft. addition to carpet mill, also a 1 story storage building, at plant here. Estimated cost $80,000. Private plans.

Mich., Kalamazoo—City election in September to vote on $2,000,000 bond issue, for a gas plant consisting of 6 buildings. Preliminary survey is being made by Burns & McDonnell, engrs., 400 Interstate Bldg., Kansas City, Mo.

N. J., Trenton—The Panelyte Board Co., 119 North Montgomery St., plans to build a factory on Whiteheads Rd., for the manufacture of cardboard products. Estimated cost $150,000.

N. Y., Jamestown—Ideal-Peerless Laundry Co., 26 Forest Ave., has awarded the contract for the construction of a laundry addition. Estimated cost $15,000. Noted July 13.

N. Y., Niagara Falls—Kimberly-Clark Co., Inc., Packard Rd., plans to build a paper plant and store house addition. Estimated cost $14,000. Private plans.

N. Y., Rochester—Powertown Tire Corp., Ridgeway Ave., plans to build a 40 x 125 ft. tire service station and salesroom on East Ave. Estimated cost $40,000.

N. Y., Rochester—Rochester Composite Brick Co., East Ave., plans to rebuild portion of plant destroyed by fire. Estimated cost $80,000.

O., Cleveland—L. Bondy Harness Co., c/o C. Bondy, 730 Bway., plans to build a 2 story, 46 x 110 ft. commercial building and factory at 3333 Superior Ave. Estimated cost $40,000. H. Nare, c/o owner, Archt.

O., Cleveland—Wolf Envelope Co., 1749 East 22nd St., is having plans prepared for the construction of a 1 story, 84 x 130 ft. factory addition. Estimated cost $50,000. N. G. Dryfoos, Pres.

O., Warren—General Fire Extinguisher Co., had plans prepared for the construction of a 4 story, 80 x 200 ft. factory. Estimated cost $300,000. W. A. Neracher, Vice. Pres. G. S. Rider & Co., Century Bldg., Cleveland, Archts.

O., Williamsburg—Williamsburg Furniture Co., is having plans prepared for the construction of a 2 story furniture factory. Estimated cost $40,000. J. F. Knight, Pres.

Okla., Bartlesville—Phillips Petroleum Co. plans to build a 4 unit gasoline absorption plant, daily capacity 10,000,000 ft. Estimated cost $400,000. Architect not announced.

Okla., Oklahoma City—Apco Refining Co., Colcord Bldg., plans to build a refinery, capacity 700 bbls. per day. Estimated cost $50,000. Architect not announced.

Pa., Bridgeport—J. Lees & Sons, have awarded the contract for the construction of a 5 story, 103 x 132 ft. factory for the manufacture of textiles.

Pa., Columbia—Peerless Folding Box & Crate Co., c/o F. S. Shuman, Swank Annex, Johnstown, plans to build a 1 story, 50 x 200 ft. factory, for the manufacture of boxes and crates, here. Architect not selected.

Pa., Lancaster—E. A. Wilson, Archt., 1208 Chestnut St., Phila., is receiving bids for the construction of a 3 story, 80 x 176 ft. cigar factory, here, for Bayuk Bros., 3rd and Spruce Sts., Phila. Estimated cost $70,000. Noted June 29.

Pa., Phila.—Bayuk Bros., 3rd and Spruce Sts., have awarded the contract for the construction of a 4 story, 84 x 109 ft. cigar factory on 10th and Bainbridge Sts. Estimated cost $90,000. Noted June 22.

Pa., Phila.—Congress Cigar Co., 3rd and Spruce Sts., has awarded the contract for the construction of an 8 story, 70 x 140 ft. cigar factory at 300-4 South 3rd St. Estimated cost $150,000.

Pa., Phila.—The Phila. Partition and Building Block Co., c/o W. Chapman, Medical Arts Bldg., has awarded the contract for the construction of a 2 story, 100 x 200 ft. factory. Estimated cost $25,000.

Pa., Phila.—E. A. Wightman, Archt., Heed Bldg. is receiving bids for altering and building a 3 story factory addition for the manufacture of abdominal trusses, for Hastings & McIntosh, 912 Walnut St. Estimated cost $20,000.

Pa., Pittsburgh—Air Reduction Co., 342 Madison Ave., New York City, has purchased a site on Neville Island, here, and plans to build a plant for the manufacture of acetylene. Estimated cost $100,000. Private plans.

Pa., Pittsburgh—U. S. Drug & Chemical Co. has had plans prepared for the construction of a 3 story, 100 x 140 ft. factory, for the manufacture of drugs. Estimated cost $200,000. P. R. Possello, 406 Congress Bldg., Detroit, Archt.

Tenn., Memphis—Memphis Sash & Door Co., 673 South Dudley St., has purchased a site on R.R. St. and Roland Ave., and plans to build a 3 story, 200 x 300 ft. factory for the manufacture of sash and doors. Architect not announced.

Tenn., Nashville—M. McKissack, Archt., 331½ Cedar St., will soon receive bids for the construction of a 4 story publishing plant and office building on 4th and Cedar Sts., for the National Baptist Sunday School Bd. (negro). Estimated cost $250,000.

Wis., La Crosse—Nelson Garment Co., 111 South 2nd St., is receiving bids for the construction of a 1 story, 94 x 160 ft. factory on 3rd and Cameron Sts. Estimated cost $50,000. O. J. Sorenson, 216 Main St., Archt.

Wis., Marinette—Heath Cedar Co., 1863 Riverside Ave., will build a 1 story, 50 x 100 ft. factory addition on Sherman and State Sts. Private plans.

Wis., Platteville—E. H. Johnson plans to build a 1 and 2 story, 60 x 150 ft. toy factory. Estimated cost $60,000. Architect not selected.

Wis., Racine—Horlick Malted Milk Co., Horlicksville, had plans prepared for the construction of a 5 story, 123 x 123 ft. manufacturing plant. Estimated cost $200,000. L. Lehle, 3810 Bway, Chicago, Archt.

Wis., Racine—Wisconsin Gas & Electric Co., 305 6th St., is receiving bids for the construction of a 1 story, 50 x 95 ft. addition to its gas plant. Estimated cost $40,000. S. B. Sherman, Supt. Private plans.

Wyo., Casper—The Fargo Oil Co., Poison Spider Oil Field (near Casper), will build a gasoline compression plant, daily capacity 10,000,000 cu.ft. Estimated cost $100,000.

B. C., New Westminster—New Westminster Paper Mills, Ltd., has awarded the contract for the construction of a paper mill on the North Arm of the Frazer River, on the Indian Reserve. Estimated cost $100,000. Private plans.

Ont., Collingwood—J. H. Yates plans to build a tannery. Estimated cost $100,000. Private plans.

Ont., Toronto—Kingston Road Lumber Co., Ltd., 828 Kingston Rd., has purchased a site and plans to build a planing mill next year. Will require all kinds of woodworking machinery.

Ont., Wallaceburg—Sydenham Brick & Tile Co. plans to build an addition to its brick and tile plant. Estimated cost $30,000. E. Morse, Genl. Mgr. Architect not announced.